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Rupert Downes Memorial Lecture.¹

SOME MEDICAL ASPECTS OF ATOMIC WARFARE.

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I AM deeply conscious of the honour you have done me in inviting me to give the first Rupert Downes Memorial Lecture. At the same time, I am grateful for the opportunity to pay my tribute to the memory of a man who was my intimate and valued friend for over forty years, and to whom the medical profession in this State, the community amongst whom he worked and the military forces of this country owe so much.

Rupert Major Downes was born in Adelaide in 1885. He was the son of a distinguished soldier—the late Major-General Francis Downes, a British regular officer—who at the time of Rupert's birth was commandant of the military forces of the Colony of South Australia. Early in Rupert's childhood his father was promoted to a similar position in Victoria, where the greater part of Rupert's schooldays were spent and where he made his permanent home. He grew up in surroundings where the accepted standards of manliness were those of the British military officer of the Victorian era, and those standards of honour, duty and service he accepted and maintained steadfastly throughout his life.

Under these circumstances, it is not surprising that his chief interest was always in the army. Prevented by financial difficulties from attending Sandhurst to qualify for a commission in the British Regular Army, he decided to make the medical profession his career. However, whilst

still at school he joined the field artillery as a trumpeter in 1897. His military service continued unbroken until his retirement in 1944. In his student days he served with the Melbourne University Rifles and soon after graduation was appointed to his first commission as a captain in the Army Medical Corps.

On volunteering for service at the outbreak of war in 1914, he was appointed to command the Second, and later the Third, Light Horse Field Ambulance. At the age of twenty-nine years he was the youngest field ambulance commander in the Australian Imperial Force.

Throughout the severe fighting of the Gallipoli campaign his untiring energy and devotion to duty earned for him the respect and admiration of all those with whom he came in contact. After the evacuation he was promoted to the rank of colonel and appointed Assistant Director of Medical Services of the Anzac Mounted Division, and later, on its formation, he was appointed Deputy Director of Medical Services of the Desert Mounted Corps, the largest cavalry force that had ever operated under one command. In addition to the normal duties of this appointment, he was responsible for the administration of all the Australian medical units at the base and in the field. Only a man of exceptional administrative ability and vigour could have discharged this dual responsibility successfully. How well he succeeded is a matter of history, and for his distinguished services in this campaign he was mentioned in dispatches and created a Companion of the Order of Saint Michael and Saint George.

On his return to Australia he accepted the part-time appointment of Deputy Director of Medical Services Southern Command, and became responsible for the administration and training of the Australian Army Medical Corps in Victoria. At the same time he applied himself with characteristic vigour to his work at the Children's Hospital and the University of Melbourne. Concurrently with these activities he wrote the history of the army medical services in the Palestine campaign for inclusion in the official history of the War of 1914-1918.

¹ Delivered on November 3, 1950, at the Royal Australasian College of Surgeons, Melbourne.

This was the period when pacifism and disarmament were the order of the day and when the Australian military forces probably reached their lowest ebb. It was a heartbreaking time for those responsible for the training of the citizen army. But Downes threw himself wholeheartedly into the task of enlisting the active interest of the medical profession in the work of the Army Medical Corps, and it is interesting to note how many of the best type of junior members of the profession were influenced by his sustained enthusiasm and joined the militia units of the Army Medical Corps, and how thoroughly they became imbued with his deep and unselfish interest in its activities and efficiency. He was never a talker, and more by example than by precept he indicated clearly what was expected of an officer of the Army Medical Corps. The influence of his example was apparent in those who served under him. The officers trained by him during this period were to be amongst the most valued of the senior officers of the Australian Army Medical Corps in World War II and were a major factor in the attainment and maintenance of a standard of efficiency which earned it a reputation that stood extremely high in the army medical services of the world.

In 1933 a visit to the United Kingdom and Europe was spent largely in the investigation of army medical problems and in the study of the latest methods in surgery of the brain and central nervous system.

In the following year the position of Director-General of Medical Services was relinquished by Major-General G. W. Barber, and Downes, at the earnest request of his friends, accepted the appointment. His extensive historical reading, his broad outlook, his knowledge of current events and developments in medicine and warfare, well qualified him for the onerous responsibilities of his new office.

Soon after his appointment, Downes began a thorough investigation of the problems associated with the provision of medical equipment. As chairman of a special army board formed in 1935, he reorganized army medical equipment and made a most valuable survey of the possibilities of expanding local production in this field. The report of this board envisaged the wartime control of the production and distribution of medical equipment in the manner later carried out by the Medical Equipment Control Committee, which was appointed in 1938 as a subcommittee of the Central Medical Coordination Committee, this having been set up a little earlier on Downes's recommendation. The vital importance of these two committees has been fully discussed by the late Sir Alan Newton in his Stawell oration and by myself in my presidential address to the naval, military and air force section of the Australasian Medical Congress (British Medical Association) at Perth in 1948.

I fear that the people of this country have little appreciation of the debt they owe to General Downes for his work in the years immediately preceding the outbreak of war in 1939. It was entirely due to the work of the committees set up on his recommendation and under his guidance that the medical services of the civil community were maintained at a high standard throughout the war and, at the same time, medical personnel and equipment for the armed services were provided on a scale which ensured the best possible treatment for the sick and wounded.

Simultaneously with his work on the committees just referred to, Downes devoted much attention to bringing the Australian Army Medical Corps to a high state of efficiency and enthusiasm. When war broke out in 1939, the corps, though small in numbers, comprised a highly trained and keen nucleus of officers and other ranks whose efficiency enabled it to be expanded rapidly and smoothly.

Downes foresaw that the war would be world-wide in character and that Australia would be committed to the limit. Consequently he urged the necessity for the provision of large and well-equipped base hospitals in the vicinity of the capital cities, where servicemen suffering from wounds or sickness would have the benefit of the most up-to-date methods of diagnosis and treatment. He proposed that these hospitals should be handed over to the Repatriation Commission after the war for the care and treatment of ex-servicemen. Because of the great

expense involved, he encountered strong criticism and opposition. However, with the greatest energy and persistence he fought this opposition and eventually won the day. How great a boon to sick and wounded servicemen these hospitals have been, and will continue to be for many a long day, it is unnecessary for me to stress. They stand as monuments to the foresight and courage of Rupert Downes.

In 1941 he was appointed Inspector-General of Medical Services and visited the operational areas in the Middle East and Malaya, where he had the satisfaction of seeing the splendid results of the hard work he had put into the training of the army medical services before the war.

In 1942, when Australia was faced with the threat of invasion, Downes was appointed Director of Medical Services of the Second Army, a position which he held until his retirement in 1944. He was then invited to accept the responsibility of writing the medical history of the war, a task which he proceeded to carry out with his usual thoroughness. Unhappily, on his way to New Guinea to obtain firsthand information, he was killed in an air accident.

Thus Rupert Downes met his death, as I am sure he would have wished, in the service of his country. To quote from an appreciation by one of his most intimate friends: "He was brought up in the military tradition and his life was spent ennobling it." To all those who know the value of his services in World War II, it is a matter of great regret that his outstanding service went unrecognized by the country he served so well.

Though the army was always Downes's chief interest, his interest in his fellow men and his high sense of duty led him to enter with the same characteristic vigour and enthusiasm into a life of service to the community in which he lived.

He was a member of the honorary surgical staff of the Children's Hospital, Melbourne for over twenty years, and gave his enthusiastic help and support to the management committee in their efforts to improve the quality and scope of the hospital's work, particularly in their efforts to form the Orthopaedic Section at Frankston.

Throughout his professional life he was an active member of the Victorian Branch of the British Medical Association. He served on the Branch Council for many years and was elected president of the Branch in 1935. The esteem in which he was held by his fellow practitioners is shown by the fact that the Council of the Victorian Branch selected him to lecture at the medical school on professional conduct and medical ethics.

He was greatly interested in the training and registration of masseurs in Victoria and became chairman of the Masseurs Registration Board. He retained this office until 1939, when he was obliged to relinquish it owing to the heavy demands his military duties made on his time.

Linked with his military and professional life was his long association with the Venerable Order of Saint John of Jerusalem, which began in 1921 when he became Assistant Commissioner of the Saint John Ambulance Brigade in Victoria. Later he was promoted to Commissioner and was President of the Saint John Ambulance Association for many years. For his outstanding services he was made a Commander of the Order of Saint John in 1929 and a Knight of the Order in 1937.

He was an active member of the council of the Victorian Division of the Australian Red Cross Society for many years, and in 1935 became a member of the national council of the society. He was elected chairman of the national council early in 1939, but had to relinquish this position on the outbreak of war. In 1944 he was elected an honorary life member—the highest honour in the gift of the Red Cross Society.

In the words of the late Graham Butler:

No account of the life of Rupert Downes would be complete without some reference to his family. Few men have been granted the happiness in their home life that came to him. In joy and sorrow he had the unswerving help and loyalty of a devoted wife and the deep affection of his two daughters. To those of us who had the privilege of his friendship, this happy and loyal family circle will always be an outstanding memory.

Rupert Downes was a man of high attainments and broad vision, who saw the path of duty very clearly and followed it with unswerving courage. In peace and in war he gave of his best to his country and his fellow men. By his deep sincerity and honesty of purpose he gained the loyalty, respect and affection of his colleagues.

In the summer of 1945 I was looking at the cups displayed at the headquarters of the Royal Army Medical Corps at Millbank in London, and I noticed on the base of one of them an inscription which read as follows:

The pride and pomp of war goes mainly to the warrior—but in all mankind, to follow the path of duty through difficulty and danger, with undeviating rectitude, is true glory.

When I first read this my thoughts immediately went back to Rupert Downes.

I have stressed the clarity with which Downes was able to visualize the problems ahead of the medical services and the great value of the plans he laid to meet these problems, and in view of this I feel it would be appropriate in this first lecture in his memory for me to discuss briefly a grave problem that will confront the medical services of the country in the future.

During the centuries of historic warfare there has been a progressive increase in the number and range of lethal weapons and factors. Towards the end of World War II the well-known actual or potential factors were: injuries from hand weapons, primary and secondary missiles, the effects of air, water and solid blast, thermal injuries, the effects of chemical and biological agents and the ever-present hazard of epidemic disease. World War II was brought to a rapid close by the use of an entirely new weapon, the atomic bomb. With the advent of this weapon a new phase of warfare was introduced, and it is the problems in connexion with the medical aspects of this new weapon that I propose to discuss tonight.

In the past, wars have been initiated by the aggressor in a manner that has usually allowed a sufficient period of time for the mobilization of defences—both military and medical. I have already indicated the great value to this country of the medical planning undertaken by General Downes and the organization set up by him in the years immediately preceding the war. Certainly the interval between the outbreak of war and the commencement of full-scale operations gave us a further twelve months to complete our organization; but the great decrease in mortality, both from wounds and from epidemic diseases, contingent upon military operations, very clearly demonstrated the value of advance planning in medical logistics.

In the future it is probable that no such breathing space will be allowed the country attacked, and though there is a strong feeling throughout the democracies that the use of atomic weapons should be banned, the fact remains that the two most powerful nations in the world today are rapidly building up a stockpile of atomic bombs. We must, therefore, face the probability that the atomic bomb will become an accepted weapon, and that it may be used by the attacking nation, as its opening gambit, on some vital centre of the country attacked.

There is an opinion in this country that Australia, from its geographical position, would be unlikely to be subjected to such an attack. I sincerely hope this opinion is correct; but with the rapidly changing strategic situation in Asia and in the islands to the north of our country, the greatly increased speed and range of aeroplanes, the development of long-range, remotely-controlled missiles, the advent of the super-submarine with a range of many thousands of miles and capable of carrying aeroplanes, together with the probability that, in a future war, Australia will become one of the chief arsenals of the democracies in the Pacific, we should be foolish indeed if we did not realize the possibility of such an attack on some of our more vulnerable industrial centres and make what plans are possible, in advance, to limit its effect on the lives and morale of the community.

Before I go further, a brief account of the effects of an atomic burst will be helpful. These effects may be divided into three groups according to whether the bomb is exploded in the air above the target, under the water or on the ground.

Air explosions were utilized in the initial experiment at Alamo Gordo, New Mexico, in the attacks on Hiroshima and Nagasaki, and in the first Bikini experiment. Such an explosion has been defined as one in which the bomb is detonated at a sufficient height so that there is insignificant contamination of the surrounding terrain and the underlying ground by radioactive fission products as compared to that which would result from a surface explosion. The degree of contamination depends, of course, on the height at which the bomb is exploded. This type of explosion involves all the classical injurious factors of the high-explosive bomb, namely, air blast, secondary missiles, thermal radiation and fire; but in addition, there is an entirely new factor which is peculiar to the atomic bomb. This is the ionizing radiation released at the time of the burst, mainly in the form of β and γ rays and neutrons. These rays, chiefly the γ rays and neutrons, penetrate the body and damage or kill tissues, thus giving rise to the so-called acute radiation sickness.

Besides the radiation released at the time of the blast, one must consider the effects of the residual radiation of the entire area near the bomb burst. In an air burst this will not be so severe, as most of the radioactive substances formed by fission of the bomb are carried off by cloud. However, there will be some substances made radioactive by bombardment of neutrons at the time of the burst. This process is known as induced radiation.

In an underwater burst, as in the second Bikini test, most of the radioactive material will stay in the water and will be scattered over a wide area in the mist and spray caused by such an explosion. In addition, there will be induced radiation of the many elements normally found in water, especially in salt water. Thus a tremendous amount of radioactive substances will be present to contaminate such an area.

To the best of my knowledge, there is no record of any experiment to determine the effects of a ground or sub-surface burst; but one would expect there to be an intense contamination of the bomb crater and its immediate environment by radioactive substances. Probably the area affected would not be so wide as in the other two types of burst.

People who are contaminated by the dust and dirt of an air or surface explosion, or especially by the water and mist from an underwater explosion, will also suffer from acute radiation sickness. It follows that removal of personnel from the contaminated area and decontamination of their bodies is of immediate importance.

Injuries from Atomic Bombs.

Let us now consider the types of injury that occur when an atomic bomb is detonated in the air above a target. This can be best explained if the effects are considered in three concentric circular areas surrounding the bomb explosion (Figure 1).

Zone 1 is the inner circular zone which extends about 1000 yards from the ground centre of the explosion. The injuries are due to all the factors mentioned earlier. Traumatic injuries and burns will be particularly severe, but the critical factor in this zone is ionizing radiation. This zone is limited to the range within which more than an absolute lethal dose of irradiation is received, and within which everyone who is exposed will succumb to the effects of ionizing radiation.

Zone 2, approximately 2000 yards, is that zone in which the dose of radiation is within the lethal range and in which all the injurious factors in Zone 1 are of great importance, but there is increasing chance of survival from the effects of radiation as the distance from the bomb explosion increases. It is in this zone that a great therapeutic challenge exists.

Zone 3 is that zone outside Zone 2 in which the dose of radiation is sublethal. Trauma from flying debris is prominent, and flash burns of exposed or inadequately protected skin are important. Deaths will not occur from radiation sickness alone in this zone.

From a series of articles published on the clinical manifestations of radiation sickness seen in the Japanese casualties, on animal experiments in total body X-ray radiation and on the effects of atomic bomb radiation on

animals at Bikini, the clinical picture of radiation sickness in man, in the three zones we have considered, has been summarized.

In Zone 1, where the dose of radiation is in excess of 1000r (a *röntgen* is the measure of the ionizing effects of radiation), nausea, vomiting and malaise appear within a few hours. These symptoms may subside or may merge with fever and diarrhoea as early as the day after exposure. Leucocytes practically disappear within twenty-four hours, petechial and gross hæmorrhage occurs, and death results usually between the fourth and tenth days.

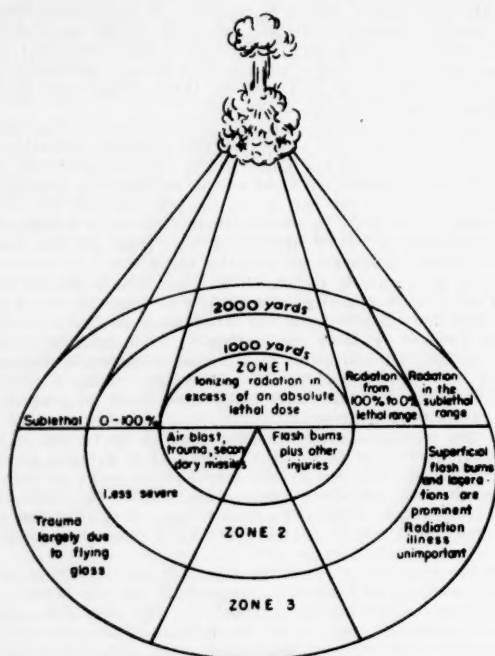


FIGURE 1.

Diagrammatic illustration of the pattern and relative importance of atomic bomb injuries in relation to distance from the explosion.

In Zone 2 the dosage varies from 1000r to 150r. The clinical course of radiation illness is generally the same throughout the zone; but, of course, the tempo of the illness is modified as the dose range decreases. In this zone vomiting, diarrhoea and malaise come on a few hours after exposure. These symptoms subside and are followed by a latent period during which symptoms are almost entirely absent. During this period the leucocytes and red blood corpuscles progressively decrease in number. The latent period in Japanese in this area was between seven and twenty-eight days, and was roughly inversely proportional to the dose of radiation received. The syndrome which followed was manifested predominantly by gastro-intestinal disturbances, sepsis, hæmorrhage and all the classical symptoms of anaemia and agranulocytosis. In fatal cases, according to whether sepsis or hæmorrhage was the predominating feature, death occurred at intervals from the second to the fifth week.

The clinical course in the sublethal range Zone 3, in which the dosage was under 150r, was similar to that in the intermediate dose range, but was less severe, and no deaths occurred solely from radiation.

I do not propose to discuss the pathogenesis of radiation sickness in any detail; but it is important to remember that all tissues of the body are affected by exposure to ionizing radiation, although each has a different degree of susceptibility. The cells of the hematopoietic system are amongst the most susceptible, and in our present

knowledge it is the effect of radiation on this system that it most important from the standpoint of the treatment of acute radiation sickness.

Happily, the reticulo-endothelial cell, the common ancestral cell for all blood cells, is remarkably resistant to irradiation, and the adult functioning blood cell remains relatively undamaged except by a very high dosage; but the intermediate cells between these two, the immature developing cells, are extremely sensitive.

The probable series of events in the three zones I have referred to has been summarized in the following way. In the sublethal dose range (Zone 3) the progenitors are injured but not irreparably so. Proliferation slows down or stops. This is manifested by lymphopenia and degenerative changes in the lymph nodes, in the spleen and particularly in the erythroid part of the bone marrow. Adult functioning cells are not much disturbed, and the progenitors are restored and reestablish the supply of new cells before a significant number of the mature functioning cells have lived out their life span. Hence there is no significant recrudescence of symptoms in this dose range. In Zone 2 there is serious injury to the progenitors. Formation of new cells ceases temporarily or completely if the dose is sufficiently high. The latent period following the initial symptoms is thought to be related to the life span of the mature cells. When replacement fails and the mature cells begin to die off it is reasonable to expect the development of symptoms referable to this system. Death would not appear to be inevitable until a dosage range is reached in which the progenitors of an essential organ system are irreparably destroyed. This occurs in Zone 1.

The pathogenesis of certain features of radiation sickness is clear. Anaemia results from cessation of red blood cell formation, with normal destruction of the red cells (at the usual rate of 0.83% of the cell mass per day). Hæmorrhage and infection, of course, will accelerate the rate at which the anaemia develops. Infections develop because of inadequate numbers of white cells to combat bacterial invaders, and because of the easy entry afforded them through traumatized areas or through the ulcerated lymphoid patches in the tonsils, throat and bowel. The pathogenesis of other features, such as the hæmorrhagic diathesis, which is so prominent throughout the lethal dose range, is not clear in the state of present knowledge; but it is thought that the hæmorrhagic diathesis is related to a fall in the number of platelets in the blood and an increase in an anti-clotting substance resembling heparin.

Treatment.

Clinical and research work to date has indicated the value of certain therapeutic measures. The value of physical and mental rest has been established, as well as the proper use of sedation and diet to lower the metabolism. Because of the lowering of resistance to infections of all sorts in these patients, the necessity for the strictest nursing care and aseptic technique will be apparent. In addition, the use of suitable antibiotics and the γ globulin fraction of serum for the prophylaxis and treatment of sepsis is of the greatest value. Poorly absorbed sulphonamides have been recommended for their ability to reduce the bacterial content of the bowel.

Blood production may cease for a period of days after exposure to the higher doses of radiation; but the normal blood destruction will continue at the rate of about 50 millilitres of red cells per day, and in the lethal dose range a hæmorrhagic syndrome always appears. This leads to rapidly developing anaemia, and to maintain the blood volume and the oxygen-carrying capacity of the blood, transfusions of whole citrated blood are clearly indicated. It is considered that, to ensure adequate replacement in a patient who has been exposed to a severe dose of total body irradiation, at least 500 millilitres should be given every two or three days, in addition to the plasma necessary to replace the lost protein.

The principle of maintaining fluid, electrolyte and acid-base equilibrium in burn cases, and in illnesses complicated by severe vomiting and diarrhoea, is well established and, of course, should be strictly observed in these cases.

Many drugs have been suggested, but so far none has been proved to be of any specific value in acute radiation sickness.

Prophylactic Measures.

I have covered briefly the various therapeutic measures that have been proved to be of value in the treatment of these casualties; but, in an atomic disaster, the medical problem is far greater than that of collecting and treating casualties due to ionizing radiation, for the vast majority of the casualties will be suffering from severe burns and traumatic injuries, and these will constitute the major problem in the first few days following the attack. The problem of burns in atomic warfare has been fully discussed in an article by Professor E. J. Evans in a recent number of *The Journal of the American Medical Association*.

Any organization designed to meet the emergency created by the bursting of an atomic bomb, if it is to be of any value, must be realistic. By that I mean that our energies must be concentrated on the collection, evacuation, decontamination and treatment of those who have a chance of survival. In order to do this effectively, it will be necessary to segregate the casualties into three groups: (i) those who will inevitably die of radiation sickness; (ii) those who have had a possibly lethal dose of irradiation but who have a chance of survival with treatment; and (iii) those who have sustained only a sub-lethal dose and will not die of acute radiation sickness alone.

All workers in this field are of the opinion that such a segregation cannot be accurately undertaken until a simple casualty dosimeter has been produced, and until such a time the only practical way to segregate the casualties will be in relation to their distance from the ground centre of the atomic burst.

It will be obvious that practically all exposed persons in Zone 1, quite apart from their visible injuries from burns, crushing injuries, fractures and lacerated wounds, must inevitably die in a matter of days or weeks from the effects of a dose of ionizing radiation in excess of the absolute lethal dose, and in the interest of the potential survivors only humanitarian palliative care can be given to this group.

In Zone 2 a large number of those who do not succumb to traumatic injuries or burns will have a chance of survival from exposure to radiation. They should be removed from the area as soon as possible, decontaminated and admitted to a hospital where facilities for good nursing, blood transfusions and prophylactic treatment by antibiotics are freely available.

In Zone 3 the chief problem will be flash burns and trauma from flying debris, and in order to save congestion of casualties they should be given first aid treatment and evacuated completely out of the area as soon as possible, or returned to duty.

It was the universal opinion of all medical observers in Japan that many thousands of lives could have been saved if prompt adequate care of wounds had been possible and if blood transfusion and penicillin had been available in large quantities; in other words, if an adequate disaster plan had been set up.

What are the essentials of such a plan? In the first place, an effort must be made to provide protection against the effects of ionizing radiation. To the best of my knowledge, lead is the only substance which gives complete protection from radiation; but, for practical purposes, three or four feet of concrete, or an equivalent thickness of earth, or a few inches of steel, will absorb sufficient of the γ rays to prevent a person so protected from receiving a lethal dose of radiation. This emphasizes the importance of the provision of adequate concrete or underground shelters, which would probably save many lives. It will be realized that dispersal of industry is of paramount importance, and this holds also for medical facilities. In the future planning of hospitals in large cities, the most serious consideration should be given to building them

some miles out from the centre of the city, with an outpatient department including one or two small emergency wards in the densely populated area.

A vast amount of whole blood, serum and its fractions, will be required for the treatment of burns and radiation sickness. It will be necessary, therefore, to organize blood donor centres, not only in the periphery of any vital centre of industry considered vulnerable to atomic attack, but also throughout the country, so that large quantities of blood can be collected quickly and transported to the stricken area. Suitable buildings must be earmarked for the purpose and the necessary equipment procured, stored in the vicinity and regularly inspected to ensure that it is in good working order. Regular working teams must be trained to man each of these centres.

Decontamination centres must be established. As in the case of blood donor centres, buildings should be selected in the outer suburban areas that can be used as decontamination centres, with adequate shower and wash-basin accommodation, where patients evacuated from the contaminated area can have their contaminated clothing removed and their bodies washed with soap and water to remove radioactive dirt or grime, and be provided with clean clothing before being evacuated to emergency hospitals.

Schools and other buildings that can be quickly transformed into emergency hospitals should be selected in the vicinity of the blood banks and decontamination centres on the outskirts of the city, where patients will be received from the decontamination centres, and where facilities will be available for transfusion and urgent surgical and medical treatment. Many patients will be too seriously injured to pass through the decontamination stations, so that it will be necessary to make provision for a "dirty" ward where such patients may be admitted and decontaminated when their medical condition permits. The equipment for these hospitals should be procured and stored in the vicinity and the staff selected and trained so that they can go into operation with the minimum of delay.

Plans should be made for the provision of emergency air, rail and road transport to evacuate large numbers of seriously injured patients to distant centres where full hospital accommodation and treatment are available.

Adequate stockpiles of morphine, dressings, penicillin and other antibiotics, serum and its fractions and blood substitutes such as "Dextran", should be laid down in places where they can be quickly made available to vulnerable areas.

It will be necessary to organize and train rescue squads in large numbers. The members of these squads should be thoroughly trained in first aid and in the effects of atomic radiation and the precautions necessary for those working in surroundings that have been rendered radioactive. It will also be necessary to train personnel in the use of radiation detection instruments and to act as monitors in radioactive centres of the blasted area. The training of this personnel, together with that of the personnel for blood banks, decontamination centres and emergency hospitals, is one of the biggest and most urgent problems. It should be initiated without delay, for it is of little use making provision for hospitals, blood banks and decontamination centres, and providing stockpiles of drugs, blood derivatives and blood substitutes, unless the specialist personnel has been trained in advance.

It will be obvious that the main problem will be caring for patients in numbers that would swamp the normally available facilities, even in the improbable circumstances that facilities were not appreciably damaged. Dispersion of facilities thus becomes of the utmost importance, as does organization of emergency work over wide areas, so that outside help can come to the rescue of bombed areas, and so that patients capable of being moved can be evacuated to places where they can receive better care.

The magnitude of the problem may be better understood if it is realized that the bursting of an atomic bomb, such as that used at Hiroshima, is equivalent to the setting off

of 20,000 tons of trinitrotoluene. In a large city it would be unrealistic to prepare for fewer than 40,000 to 50,000 cases of severe burns alone.

The responsibility for setting up an organization to cope with an atomic disaster rests with the civil defence authorities and the services, who will require the full cooperation of the medical profession and such organizations as the Order of Saint John of Jerusalem and the Australian Red Cross Society. Both the Order of Saint John and the Red Cross could undertake the responsibility for the formation and training of the large number of first aid squads that will be required, and the Red Cross Society, through its national Blood Transfusion Service, could train extra technicians and organize blood donor centres.

It appears most desirable that a course for medical practitioners in the physical and medical aspects of radiation should be instituted in the same way as is being done in other countries, notably the United States of America, where, in addition, fellowships for research in this field have been established.

Careful consideration should also be given to education of the public in those aspects of atomic warfare on which it would be desirable for them to be informed.

Conclusion.

I have concentrated in my talk on the effects of the ionizing radiation consequent upon an atomic attack because this is a new factor in war; but it must be emphasized that this is not the greatest or the most urgent problem to be faced. The primary problem will be the emergency created by the vast number of casualties from the effects of blast and burns—an emergency that will follow immediately on the bursting of an atomic bomb. Fortunately, severe symptoms from radiation in those not killed outright by it do not usually come on until several days after the acute exposure, so that casualties suffering from burns and mechanical injuries will actually constitute the immediate problem and make their heaviest demands on emergency facilities at a time when those suffering solely from acute radiation will require very little attention.

In the time at my disposal I have endeavoured to give you an idea of some of the more important medical problems of atomic warfare. The task of setting up an efficient emergency organization to cope with such a disaster is formidable, but by no means insuperable, provided that sufficient time is available.

Let us be realistic and face the fact that Australia is no longer able to rely for safety on her geographical isolation, and that some of our vital centres of industry could be the target of an atomic attack. As I previously stated, the responsibility for the organization of an adequate disaster set-up lies with the civil defence authorities and the services, and I am most strongly of the opinion that no time should be lost by them in initiating the action necessary to discharge this responsibility. To this end they should immediately appoint an expert committee to advise them.

Acknowledgements.

I wish to express my thanks to Lieutenant-Colonel Carl F. Tessmer, of the Medical Corps, United States Army, who very kindly procured for me the relative papers and pamphlets published with the authority of the United States Atomic Energy Commission. Without his help in procuring these publications I could not have prepared this paper.

In my account of the symptoms, pathogenesis and treatment of acute radiation sickness, I have quoted freely from a paper by Eugene P. Cronkite and William H. Chapman (1949), the Sir Henry Wellcome prize essay for 1948.

Reference.

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RECENT ADVANCES IN RHEUMATOLOGY, PHYSICAL MEDICINE AND REHABILITATION.¹

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DURING the past ten years, incorporating wartime experience and the post-war rehabilitation programmes, there has been considerable progress in research in rheumatology and in the clinical application of physical medicine, which is one of the most valuable adjuncts in the management of the arthritic patient. Rheumatology, physical medicine and rehabilitation are closely allied and interrelated in treatment, and cover an enormous field of medicine which in the past has been sadly neglected.

RHEUMATOLOGY.

Rheumatology is the study of the rheumatic diseases, including arthritis, rheumatic fever, fibrositis, neuralgia, myositis, bursitis, gout and other allied conditions of the musculo-skeletal system associated with muscular stiffness and soreness and producing somatic pain.

Recent Observations on Rheumatism as a National Problem.

Rheumatic diseases are the commonest cause of chronic illness in most temperate countries of the world, and rank second only to nervous and mental illnesses combined in causing the greatest temporary and permanent disability. Paradoxically, among the chronic diseases rheumatism causes the highest morbidity and the lowest mortality. In other words, it cripples in the largest number and kills in the smallest.

As an indication of the great prevalence of rheumatism it must be pointed out that it is more common than the total number of cases of tuberculosis, diabetes, cancer and heart disease combined, and causes more crippling, higher economic loss and greater human suffering than do other medical illnesses. Chronic rheumatic diseases are the greatest scourge of modern civilization and have amply earned the title "Public Health Enemy Number 1". In England, chronic rheumatic diseases cause one-sixth of the total invalidism of the insured population. It has been estimated that in the United States of America one in every 20 persons has some form of rheumatic disease. From surveys carried out, Rusk of New York recently stated that the number of arthritics in the United States of America exceeded 7,000,000.

In Sweden, Russia and other continental countries the respective governments have accepted the fact that chronic rheumatic diseases constitute the major cause of invalidity, and they have put into operation plans for the control of this scourge. In Australia, although no national health surveys have been made, individual hospital records indicate a high percentage of patients similarly affected. When the limited manpower in Australia is considered, the importance of the rheumatic problem in industry is all the greater, in view of the annual economic loss to the nation in manpower hours in production and in the unemployment of crippled and disabled persons. Although the establishment of post-war rehabilitation centres indicates recognition of the gravity of the condition by the Government, yet the lack of hospital facilities for the proper care of arthritic patients is appalling. Under existing conditions, a large percentage of arthritics either receive no medical treatment or treat themselves.

The war against rheumatic diseases is even more than a national matter. In fact, it has assumed international importance, as is evidenced, after the lapse of a decade, in the record attendance and the great interest shown by rheumatologists at the seventh International Congress on Rheumatic Diseases recently held in New York, and at other rheumatism clinics in the United States of America. Significant advances in research have taken place in the

¹ Delivered at a meeting of the Australian Section of Physical Medicine (British Medical Association) on November 8, 1949, at Melbourne.

United States in the post-war period, including the establishment of the Arthritis and Rheumatism Foundation under the sponsorship of the American Rheumatism Association for the purpose of conducting a nation-wide campaign to raise funds for research programmes and establishment of fellowships in order to discover the cause, to improve existing methods of treatment and to prevent arthritis and deformities. In Australia, we lack adequate facilities for early diagnosis, research, therapy with admission to hospital and sufficient undergraduate and post-graduate education in the rheumatic diseases. Until a comprehensive national plan is inaugurated to combat rheumatic diseases, the brunt of the responsibility for early diagnosis and treatment will continue to fall on the already overburdened general practitioner.

Although investigations and treatment are not only protracted, but also time-consuming, it is of the greatest importance that all physicians acquire a reasonable degree of knowledge of these diseases, sufficient to aid in preventing deformity and the dreaded physical and mental crippling which are often the result in neglected cases.

Causes of the most important rheumatic diseases still remain unknown and consequently some confusion still exists in reference to classification. After working for the past ten years on this problem, a committee of the American Rheumatism Association has prepared as a working basis for clinical work a simplified classification under eleven major headings from the hundred or more conditions included among rheumatic diseases.

Recent Diagnostic and Therapeutic Considerations.

Among recent advances which have been made in diagnostic procedures, reference should be made to articular biopsy and the examination of subcutaneous nodules in the differential diagnosis between gout and rheumatoid arthritis, and to the diagnostic value of synovial fluid findings in differentiating infectious and rheumatoid arthritis from traumatic arthritis. According to Ropes, mucin changes are often of great value in the differential diagnosis of joint disease, and occasionally aid in estimating the prognosis when mucin becomes more normal as the joint involvement subsides. The presence of considerable degeneration of mucin tends to rule out the traumatic type of joint disease.

The significance of inflammatory myositis associated with rheumatoid arthritic joints has been appreciated only recently.

Recent investigations have shown adrenocortical dysfunction in gout. The administration of pituitary adrenocorticotrophic hormone (ACTH) is followed by a considerable increase in urate excretion in normal subjects. There is suggestive but not conclusive evidence that acute attacks of gout tend to occur at times of decreased adrenocortical activity. Adrenocorticotrophic hormone also mobilizes uric acid and can precipitate or relieve attacks of gouty arthritis.

Synovial Effusions.

Recent investigations have stressed the value of examining the joint fluid bacteriologically and cytologically, and of examining the fluid for blood or blood derivatives. The presence of pus and organisms clinches the diagnosis of septic arthritis. Rheumatoid arthritis can be differentiated from osteoarthritis owing to the high leucocyte count—in the region of 20,000 per millilitre in rheumatoid arthritis as compared with 2000 cells per millilitre in osteoarthritis. Traumatic effusions always contain either blood or blood pigments, according to the period since the trauma was sustained. Biopsy of synovial tissues and the examination of regional lymph glands are useful procedures in suspected tuberculous arthritis.

Blood Sedimentation Rate.

A normal blood sedimentation rate is usually found in fibrositis, osteoarthritis and traumatic arthritis, and often during the free intervals of gouty arthritis. A raised blood sedimentation rate is helpful in the diagnosis and treatment of rheumatoid arthritis, because it roughly parallels the extent and severity of the arthritic process.

For this reason, it is useful as a measuring-stick of the effectiveness of various forms of therapy, especially gold therapy. A normal sedimentation rate should be one of the criteria on which it is concluded that a patient's rheumatoid arthritis has become quiescent or is cured; however, the history and clinical findings are essential in establishing the final diagnosis.

According to Gibson, of Bath, in the assessment of improvement or deterioration in a case of rheumatoid arthritis, the repeated determinations of the blood sedimentation rate are more informative than estimations of blood plasma viscosity. However, plasma viscosity estimation has an important place as an aid to the clinical assessment of activity of rheumatic disease. In a series of cases in which progress is being watched, it supplements but does not replace the blood sedimentation rate estimation.

Cortisone.

The recent discovery by Hench and his colleagues at the Mayo Clinic of the beneficial therapeutic effect of cortisone (17-hydroxy-11 dehydro-corticosterone—Kendall's Compound E) and of adrenocorticotrophic hormone (ACTH) in rheumatoid arthritis was undoubtedly of remarkable significance. The fact that identical effects in arthritis also occur in response to pituitary adrenocorticotrophic hormone (ACTH) suggests that the primary defect is subnormal pituitary stimulation rather than primary adrenocortical exhaustion. In Addison's disease it is rare to find rheumatoid arthritis. The action of cortisone appears to be pharmacodynamic rather than of replacement type.

Apparently, in rheumatoid arthritis there is not a simple deficiency of adrenal cortex hormone comparable to the deficiency of insulin in diabetes. Treatment with cortisone is therefore not considered as mere substitution therapy. Compound E is a hormone obtained from ox bile and is in very short supply owing to the complexity of the production process. Prospects of synthesis from *Strophanthus sarmentosus*, a plant grown in Africa as a source of Compound E, are more encouraging. Patients treated with Compound E experience something which is entirely new in the field of rheumatology. First, there is relief of muscular pain and stiffness often within a few days. Remarkable remissions occur even in severe rheumatoid arthritis. Muscular strength increases. The blood sedimentation rate returns to normal. There occurs diminution of joint pain and tenderness and ultimately reduction in swelling with increased joint motion. Fatigue, anorexia and toxæmic symptoms are replaced by a good appetite, gain in weight and sense of well-being. Patients experience an emotional and mental "uplift" accompanied by increased mental capacity and activity. Cortisone, by its pronounced physiological effects, has opened up a new field of research in rheumatoid arthritis, and has furnished an explanation for previously unrelated factors in rheumatoid arthritis, such as the well-known adrenal cortical hypertrophy of pregnancy with accompanied improvement. Although the rationale of cortisone treatment is not as yet fully understood, it may be that the beneficial effect of treatment with salicylates, colchicine and adrenaline, the intravenous injection of typhoid vaccine, starvation and exercise, is due to their stimulating effect on the pituitary adrenal axis.

Sufficient time has not yet elapsed, and further research is necessary, to permit an evaluation of Compound E in terms of everyday treatment. Recent investigations in the structure of the synovial membrane in severe rheumatoid arthritis have shown evidence of pronounced perivascular lymphocytic infiltration, especially in the vascular circle at the periphery of the articular cartilage. Synovial tissues have a great capacity for repair and regeneration in contrast to articular cartilage, which is an avascular structure. These facts support the views of Hench and his co-workers at the Mayo Clinic in reference to the reversibility of joint inflammation, particularly in its less chronic forms.

Résumé of Treatment of Rheumatoid Arthritis.

Three essentials are necessary before any regime of treatment is adopted in any individual case: (1) estab-

lishment of an accurate diagnosis of the type of rheumatic disease present, the stage of the disease and the degree of functional impairment; (ii) clinical estimation of the degree of activity of the disease process; rheumatoid activity represents the basis for assessing the effectiveness of any therapeutic agent; (iii) ability to secure the cooperation of the patient for treatment of an illness often of long duration.

Treatment varies with the stage of the disease process. Considerable improvement or arrest of the joint symptoms is often possible in the very early stage. Rheumatoid arthritis is a systemic generalized disease for which no specific rapid cure is available at present; the joint manifestations are only part of the illness. In the planning of treatment, which may be of long duration, more stress has recently been laid on obtaining the full cooperation of the patient to help himself whilst under supervision. Bed rest is essential during an exacerbation or active stage of the disease. Later, by his own efforts, the patient can carry out proper exercises and self-applied home physical therapeutic measures.

Measures of Proved Value in Rheumatoid Arthritis.

Measures of proved value in rheumatoid arthritis include the following: (i) Rest of the involved joints with splinting to prevent deformity. (ii) Physical therapy (heat, massage and special exercises) and occupational therapy—in most cases the most neglected and useful method of treatment in rheumatoid arthritis. (iii) Diet, well balanced and rich in vitamins. (iv) Relief of pain by splinting of affected joints, rest, physical therapy, analgesics (aspirin, calcium acetyl salicylate, codein *et cetera*). (v) Orthopaedic measures including the application of splints, jackets and supports; manipulation of joints and orthopaedic surgery when required. (vi) Gold therapy. (vii) Removal of proved focal infection. (viii) Blood transfusions to combat secondary anaemia. (ix) Symptomatic treatment including the exhibition of salicylates, iron and vitamins. (x) X-ray therapy for rheumatoid spondylitis.

Prevention of Deformity in Arthritis.

It is the duty of every general practitioner to prevent the occurrence of deformities. Prevention of a deformity is easier than correction. Most of the tragic deformities consist of fixed flexion of knees, hips, elbows, wrists and ankles. In the early stages of arthritis deformities result from muscular spasm, which must be inhibited promptly, otherwise actual shortening may occur in the joint capsule leading to fibrosis and bony ankylosis, flexion contractures and gross deformities.

Never place pillows under knees. This error is the commonest cause of flexion deformity at the knee joint, aggravated later by distortion produced by allowing the patient to walk on a flexed knee joint.

A non-sagging mattress, supported by plywood bed boards, must be used. Avoid a soft mattress and sagging spring.

Regard all acutely inflamed joints as potentially deformed.

Proper splinting of joints is essential. For that purpose the use of plaster of Paris is best, in that the splint can be "bivalved" and readily removed in the daytime for heat treatment and exercises.

It has only recently been realized that much of the limitation of movement in early rheumatoid arthritis is to be attributed to spasm of the surrounding muscles of a joint rather than to any true intraarticular disease. This spasm will pass off in four or five days if the affected joint, including the joints above and below, is immobilized.

Observance of the correct position of optimum function of individual joints is imperative in order to prevent ankylosis in a faulty position.

Correction of Deformities in Special Joints.

Knee-flexion deformity may be corrected by traction in the line of the deformity or by the application of serial and wedge plaster casts, a most important recent advance in technique. Gentle manipulation under anaesthesia,

followed by the application of a plaster cast, is advised in order to maintain the correction. Plaster casts should be "bivalved", preferably within forty-eight hours, so as to make possible the use of the posterior half as a resting shell. This permits heat treatment during the day, followed by a range of painless motion. Painful movement of the joint does not occur when it is held firmly in a bivalved cast.

When the feet are painful and swollen, weight bearing is contraindicated. A plaster moulded posterior splint may be applied, extending from below the knee to beyond the tips of the toes, and thence "bivalved" for daily removal for application of heat and motion in order to avoid formation of adhesions.

In the spine, X-ray therapy is one of the most useful measures in relieving pain and muscle spasm and in arresting the progress of rheumatoid spondylitis. A plaster and, later, a celluloid laced body jacket is advised for support in the lumbo-dorsal region and a Thomas collar in the cervical region, followed by head traction and the application of hot fomentations.

For the wrist, apply a moulded plaster splint with the hand in half-fist position—that is, dorsiflexion of about 35°, the splint extending from the upper part of the forearm to the palmar crease. The splint may include the fingers if they are swollen and painful. If ankylosis is inevitable, then allow fusion in a useful position of dorsiflexion.

Prevent ulnar deviation of the hands by the use of a moulded plaster splint extending from the forearm to the fingertips, with dorsiflexion of the wrist and moderate flexion of the fingers. A flange inserted on the ulnar edge of the hand prevents ulnar deviation of the fingers.

Daily finger exercises and warm paraffin "dips" are given to relieve muscle spasm and pain. For the correction and prevention of deformity physostigmine salicylate and atropine sulphate are also antispasmodic and analgesic.

The "clam shell" cuff devised by Swaim to prevent interphalangeal and metacarpo-phalangeal subluxations consists of a piece of felt and a plaster slab, which is moulded and permitted to harden around the subluxated joint in corrected position. When dry, it may be held on the hand with an elastic band.

Gold Therapy.

Gold lessens the progress of active rheumatoid arthritis.

Forestier expressed his continued satisfaction with gold in a recent address delivered in New York. With early treatment, he obtains remissions in 33% of cases and partial improvement in 35% of cases. Correct diagnosis is essential. Bayles of Boston lays stress on the selection of patients suitable for gold therapy by the presence of the following criteria: (i) active rheumatoid arthritis with inflammatory tissue about joints; (ii) a high blood sedimentation rate; (iii) anaemia and loss of weight after the usual conservative measures have been tried for three or six months and before irreparable joint damage has taken place.

Contraindications to the use of gold therapy are the following factors: (i) all other forms of arthritis—namely, gout and hypertrophic arthritis; (ii) advanced age, and the presence of burnt-out and crippling rheumatoid arthritis; (iii) allergic states; (iv) blood, liver or kidney disease.

The ideal subject for gold therapy is one in the early active stages of rheumatoid arthritis with synovial involvement and with no gross joint damage. Synovial tissues have great powers of regeneration, thus permitting reversibility at this early stage.

Dosage.

In contrast to the large doses of gold previously given in several courses of treatment, the pendulum has now swung in favour of the smaller initial dosage of 25 milligrammes as a safer dose followed by weekly injections of 50 milligrammes until improvement occurs, and then followed by a maintenance dose of 50 milligrammes per month, extending over a long period, even years. Most

rheumatologists are in agreement that 50 milligrammes are an efficient therapeutic dose with the smallest risk of producing toxic reactions. It is the duty and responsibility of the medical attendant to inquire into possible toxic reactions before going blindly ahead with further treatment. A most important advance in regard to chrysotherapy in rheumatoid arthritis during the past few years has been the discovery of the effectiveness of 2,3-dimercapto-propanol (BAL) in the treatment of toxic reactions from gold therapy—namely, exfoliative dermatitis, granulocytopenia and severe thrombocytic purpura.

Orthopaedic Treatment of Chronic Arthritis.

In properly selected cases of rheumatoid arthritis, the use of manipulation is of considerable value. However, certain criteria must be observed, as follows: (i) absence of activity of disease and bony ankylosis of the joint, patella *et cetera*; (ii) careful study of the X-ray film in regard to decalcification, to prevent fracture; (iii) absence of subluxation, which is a contraindication in most cases. Knees, hips and shoulders usually respond well to manipulation in selected cases; less so do wrists, ankles and elbows.

Procaine injection of periarticular structures followed by heat and movements is often sufficient to eliminate pain and to restore full function in a moderate degree of disability associated with fibrous ankylosis. At the shoulder joint the use of an aeroplane splint is of value in after-treatment. In selected cases, repeated careful manipulation under general anaesthesia is indicated followed by heat and exercises. It must be stressed that manipulation without proper after-treatment is generally useless and may be actually harmful.

Unless effective after-treatment in the form of heat, sedation and exercises is carried out, there is a tendency for adhesions to reform even within twenty-four hours of manipulation, thus defeating the whole object of joint mobilization.

Orthopaedic Surgery in Arthritis.

Recent advances can also be recorded in the field of orthopaedic surgery in arthritis; however, the surgery of chronic arthritis is patchwork surgery. In selected cases it is a useful adjunct in treatment. If serial plaster casts and manipulation fail to correct a deformity, then surgery should be considered after the observation of important criteria—namely, (i) quiescence of the arthritic process for six months and (ii) reasonably good general condition and musculature of the patient for proper training in muscular exercises before the operation and also post-operatively. For fixed flexion contracture of the knee a posterior capsuloplasty followed by fixation in full extension in a plaster cast gives the best result if the chief deformity is due to contracture of the soft parts and there is little destruction or distortion of the articular surfaces.

Synovectomy or arthrodesis of the knee joint may be indicated in selected cases for correction of deformity.

In ankylosis of the hips, knees and elbows, satisfactory results have been obtained by arthroplasty. *Fascia lata* is the most satisfactory tissue for interposition in the upper extremity, but wears out quickly in weight-bearing joints. Thin nylon membrane has so far been the best material for interposition between the joint surfaces in the recent operation of nylon arthroplasty of the knee joint.

The Smith-Petersen vitallium cup arthroplasty of the hip joint is a useful operation in selected cases. The condition of the hip musculature is the most important factor in influencing the result.

Earlier consideration of arthroplasty is advisable before the hip muscles have become fibrotic, as is found in old chronic rheumatoid hips.

In successful cases, there are freedom from pain and a range of movement on the average of 40% of normal. In a recent demonstration by Smith-Petersen at Boston, visiting rheumatologists were impressed by his results, by the soundness of the pre-operative and post-operative care, by the pre-operative muscle-setting and muscle training exercises, by the early active motion while the patient is still

in bed, by the forbidding of weight-bearing for four to six weeks, and by the prolonged use of crutches.

Relief of Pain in Arthritis of the Hip Joint.

The denervation operation of obturator neurectomy—that is, the extraperitoneal resection of the obturator nerve and the division of the branch of the sciatic nerve to the *quadratus femoris* (the main posterior articular supply) is another recent useful procedure for the relief of intractable pain in severe osteoarthritis of the hip joint. Cyriax considers that most of the pain is extraarticular in origin and is not due to the osteophytes. He obtains relief of pain by stretching exercises following short-wave diathermy treatment and procaine injection of the capsule of the hip joint.

Intraarticular joint injections are of great value in selected cases. The beneficial effect has been attributed to their acid content; however, non-acid solutions such as procaine and 10% benzyl benzoate solution are also used.

In partially ankylosed joints, part of the benefit is due to the initial mobilization under local analgesia followed by further gentle manipulation and exercises in the after-treatment.

Owing to the sensitivity of some of his patients to procaine, Grant Waugh has discontinued its use in his injections of lactic acid, and still claims continued good results independent of any local analgesic action.

Prognostic Considerations.

The prognosis for many of the arthritics is now more hopeful and encouraging. The best results in treatment are not obtained by the use of any single measure, but from the continued application of a programme of medical, physical, therapeutic and orthopaedic measures.

Many authorities, including Tegner, regard physical therapy, including heat, rest and mobilization, as the sheet anchor in treatment. However, physical therapy in arthritis should not be used to the exclusion of other anti-arthritic treatment. Nevertheless, for patients suffering from chronic arthritis, it is probably the most important single factor in treatment.

The triad of heat, massage and graded exercises should be used in practically every chronic case every day. Superficially applied dry and moist heat is useful for joints such as the knee, elbow, ankle and wrist; however, short-wave diathermy is more effective in producing depth heat penetration in hip and shoulder joints. It is now being recognized that regular and active exercises and repeated gentle manipulation after heat therapy are more important physically and psychologically to the cooperative patient than passively applied faradism.

Observations on the potential reversibility of rheumatoid arthritis have recently caused a revision of our thinking on the diagnosis, aetiology, prognosis and treatment of the disease.

Since rheumatoid arthritis was sometimes reversible even before the use of cortisone in the late progressive stages, it should be regarded as potentially reversible at any stage, and probably more reversible in its early stages. That the latter statement is true is shown by the fact that most remedies are more effective in the early stages. Since the discovery of cortisone, the future prospects of control of rheumatoid arthritis are now much brighter.

PHYSICAL MEDICINE.

Physical medicine includes the employment of the physical and other effective properties of light, heat, cold, water, electricity, massage, manipulation, remedial exercises and mechanical devices for physical and occupational therapy in the prevention, diagnosis and treatment of disease.

Physical medicine is really applied biophysics—that is, physics of the vital processes. Within recent years there has been a far better understanding of physical medicine with a more intelligent application of physical therapeutic measures. Physical methods of diagnosis and treatment have now become indispensable in medicine. In the beginning, physical medicine was purely therapeutic, but

with recent progress it now includes important diagnostic procedures for clinical research.

Diagnostic Physical Medicine.

Among the important procedures employed in diagnostic physical medicine, are the following: (i) Manual muscle testing and recent advances in electrodiagnosis, including the muscle chronaxie advocated as the index of excitability. (ii) Electromyography, a new method of electrodiagnosis, which makes use of the recording of small electric potentials from muscles at rest or during voluntary contraction. These action potentials are not obtained with paralysed muscles with complete denervation. Differentiation of a partial from a complete nerve lesion may be obtained by the use of a sensitive amplification and recording system such as the cathode ray oscilloscope. (iii) Goniometry or joint measurement for checking and recording the range of motion in a diseased joint with a goniometer, an inexpensive plastic instrument for measuring angles. (iv) Functional testing of the activity in daily living for rehabilitation of the injured. (v) Oscillometry, a diagnostic procedure for determining the degree of peripheral vascular disease. (vi) Skin and deep temperature determinations and diagnostic study of electric characteristics of the skin. (vii) Electrocardiography and electroencephalography.

Applied Biophysics.

Further illustrations of recent advances in the application of physics in medicine can be presented in such varied fields as the following: (i) Neurophysiology. (ii) The measurement of radiation. (iii) The use and evaluation of hearing aids. (iv) Electric shock therapy. (v) Colorimetry. (vi) Muscle nerve stimulation. (vii) The fascinating study of the electron microscope, permitting magnification of 100,000, and making possible observation in an electron photomicrograph of an infinite variety of detail never previously seen. This new microscope can render visible objects which are a fraction of an Angström unit in size (an Angström unit is $1/254$ millionth of an inch). (viii) Television interpretation of X-ray films and television demonstration of surgical operations.

Electronics.

Electronics is certainly invading medicine on a large scale, with evidence of more cooperation between the clinician, biophysicist and biochemist. There is now a firm demand for more science in medicine in the future. As the field of biophysics develops, and as the number of physical techniques and methods needed by the physician is multiplied in the modern era of electronics, the acquisition of further knowledge of medical physics is imperative in order to develop those habits of exact thinking and inquiring self-criticism which are so important to the progress of medicine in the future. In this atomic era the previous apathy towards physical medicine is tending to disappear more rapidly with new developments in the physical weapons of war which are being converted to medical uses—namely, radar, which won the battle of Britain, atomic energy, which hastened the final defeat of Japan, and ultrasonics, which aided in our supremacy of the seas in submarine warfare.

Microwave Diathermy.

Radar or microwave diathermy is one of the most interesting and promising of the new developments in physical medicine. Whereas short-wave diathermy currents have a frequency of 10,000,000 to 100,000,000 cycles per second, microwave diathermy currents have a frequency of 3,000,000,000 cycles per second. In a portable machine in use at the Mayo Clinic, the radiation is directed along a beam much like infra-red rays, but penetrates like short-wave diathermy and apparently is absorbed even better—namely, to a depth of three centimetres—and produces a considerable increase in blood flow.

Atomic Medicine.

The medical applications of atomic energy are increasing speedily. Of the greatest importance in medicine is the use of radio-isotopes as tracers to follow the action of

certain drugs and chemicals in the living animal. Radioactive iodine is being used in the diagnosis and treatment of toxic goitre and radiophosphorus in the treatment of *polycythemia vera*.

Ultrasonics.

Ultrasonics or sonar also offers possibilities in medical applications in the use of vibrations which are above the audible frequencies for the human ear. Ultrasonoscopy, by the use of high-frequency sound waves of 800,000 cycles per second, makes possible delimitation of a pathological mass in diagnosis. Ultrasonic therapy has been used for its heating and anti-spasmodic effect.

The Role of Physical Medicine in Medical Practice.

Lest further evidence of the *bona fides* of physical medicine be needed, some extracts from the British Ministry of Health's report can be quoted, as follows: Physical treatment is of great value at some stage in every type of chronic arthritis and no scheme of treatment for chronic arthritis can be considered complete unless physical methods under skilled direction are provided. In spite of the continued advances in diagnostic and therapeutic physical medicine, especially during the past ten years, it is unfortunate that many patients are still being denied its benefits as a most valuable adjunct in medicine in expediting recovery.

What is the reason? We must face up to the fact that while many physicians are competent to prescribe in pharmacology, they lack the special skill, undergraduate and post-graduate training and experience in prescribing the dosage and indications in the application of specific physiotherapeutic methods. If a *questionnaire* were sent to individual practising members of the medical profession, one would find a surprising number of otherwise very competent doctors who would profess not to believe that any special skill or experience in the prescription or application of physical therapy was really essential. The role and value of physical medicine in many branches of medical practice are often realized only after long years of difficult cases encountered in general practice.

Until physical medicine is included in the curriculum of all medical schools, it is essential that all medical men should acquire sufficient post-graduate experience and reasonable knowledge of its practical uses and indications. As a rationale of treatment in chronic arthritis the bases of most methods of physical therapy are heat, skin stimulation, mobilization and remedial exercises in hastening recovery and for retention or restoration of joint or muscle movements.

Thermotherapy.

Thermotherapy is the application of heat for therapeutic purposes. The primary physiological effects of heat are antispasmodic, analgesic, decongestive and sedative. Heat increases the exchange of oxygen and hastens the absorption of inflammatory exudates. It is a vasodilator, producing active hyperemia and increasing local metabolism. The shorter the rays the more penetrating they are.

The skin tolerates about twice as much energy from short-wave as from long-wave irradiation. Heat therapy in some form applied locally or generally is the most frequently used procedure in any department of physical medicine, usually exceeding the number of treatments for massage and therapeutic exercises. Two factors must always be considered in heat therapy—namely, (i) the amount of heat successfully applied into the tissues, and (ii) the extra amount of heat produced within the tissues as a result of the oxidation processes that have been accelerated by the active hyperemia due to the heat applied.

In inflammatory or painful conditions, better results are now being obtained by the giving of the treatment several times a day.

Conductive heat is applied directly to the body by electric pad, hot fomentations, hot baths *et cetera*. Paraffin coatings hold heat well.

The Kenny hot pack method requires that the packs be changed frequently, because, if they become cool, pain may

be increased rather than relieved. I saw them used extensively at the Los Angeles County Hospital during the recent epidemic of poliomyelitis as a useful adjunct in treatment, especially for relief of pain and muscle spasm.

Physical Medicine and Neurology.

Neurological diseases account for a large proportion of patients referred to a department of physical medicine for the purpose of diagnosis and treatment.

The effects of destructive lesions of the central nervous system of inflammatory, degenerative or neoplastic origin are not capable of being eliminated. Physical therapy is directed toward overcoming the residual disturbance of function manifested clinically as a change in muscular tone or strength of skeletal muscle, impairment of sensation or variations in carrying out coordinated movements. Treatment of upper motor neuron lesions is directed toward overcoming contractures produced by excessive muscular tone.

Spastic muscles and joints are slowly and firmly stretched after preliminary radiant heat therapy lasting half an hour, carried out three times daily and followed by corrective exercises.

Much of our training in the treatment of spastic hemiplegia depends also on the application of body mechanics. Brachial neuritis, the *scalenus anticus* syndrome and the cervical rib syndrome are often postural in origin, and can be relieved by correcting the position of the spine, head and scapulae so that the shoulders and arms fall into their proper position.

In lower motor neuron lesions, the usual electric tests are of little value in determining the first signs of recovery or nerve regeneration.

Electromyography.

Electromyography is an important advance in electrodiagnosis, and is now being used as a routine procedure in many centres in the diagnosis of peripheral nerve lesions. The information obtained by means of electromyograms includes the presence or absence of denervation fibrillation, the presence of nascent units showing early reinnervation as the first signs of neurotization of muscle, and thirdly the motor burst characteristic of normal reinnervation.

Recent advances have also been made in the treatment and rehabilitation of paraplegics and quadriplegics and of children suffering from spastic paralysis. In the past, this group of physically handicapped subjects have been a great challenge to the medical profession. Physical medicine has made a considerable contribution in the restoration of a reasonable state of health in many of such cases previously regarded as hopeless.

Intervertebral Disk Lesions.

Involvement of spinal motor and sensory roots by protrusion or degeneration of the *nucleus pulposus* of intervertebral disks is now being recognized more frequently than in the past as a common cause of low-back pain and sciatica. After trauma or disk degeneration, the most frequent site of the lesion is between the fourth and fifth lumbar vertebrae. Acute tenderness on pressure over the interspinous ligament at the site of the lesion is a valuable diagnostic sign, together with sciatic scoliosis and radiological evidence. Conservative treatment is advisable at the outset. It consists of procaine infiltration of the sacrospinalis on the convex side or epidural injection of procaine solution in selected non-scoliotic cases, followed by bed rest on a firm mattress with head and shoulders slightly raised and leg traction if severe spasm of the lumbar muscles persists.

If necessary, local applications of heat will do much to relieve pain and spasm. Hot fomentors or hot moist packs are very helpful. However, radiant heat and short-wave diathermy are more convenient in their application, since they can be repeated with a minimum disturbance of the patient. Analgesics and morphine may be required for severe pain.

Manipulation is not advisable in the acute stage and may be positively dangerous in inexperienced hands.

Immobilization is the sheet anchor of treatment in many cases of the acute stage of the low-back sciatic syndrome.

When a patient recovers without operation, the rehabilitation of convalescence should be carried out with the patient in normal posture and a jacket support. Laminectomy and bone grafting may be necessary to expedite recovery in suitable cases when the patient has a non-sedentary occupation.

Physical therapy is also useful in the after-treatment of patients requiring laminectomy for the relief of pressure on spinal nerve roots. It is imperative to guard against muscular atrophy as a result of prolonged immobilization.

Progressive resistance exercises on the principles advocated by de Lorme are helpful, especially in after-treatment of many industrial accident patients. Such resistance exercises are especially valuable in developing the musculature of the back, the abdominal wall, and the hip and knee extensors.

Reflex Sympathetic Dystrophy of the Upper Extremity.

A variety of terms have been used to describe reflex sympathetic dystrophy of the upper extremity—namely, Sudeck's acute inflammatory bone atrophy, post-traumatic vasomotor syndrome (Leriche), causalgia (Weir Mitchell), chronic traumatic oedema, and shoulder-hand syndrome. Apparently all result from the same mechanism. The condition is painful and fairly common.

The basis of this disorder appears to be the establishment of chronic reflex sympathetic hyperactivity in the upper extremity initiated by the pain and resulting in impairment of circulation and nutrition with occurrence of oedema. Interruption of the reflex pathway breaks this cycle and allows restoration of normal function.

Early in the development of the syndrome relief of pain from the original source will suffice. Once the syndrome is established, it is self-aggravated and self-maintained. It may be caused by various means, as follows: (i) more or less severe trauma or any degree of local infection of the upper extremity; (ii) unreasonable immobilization of the arm or forearm in plaster of Paris (a fairly common causative factor); (iii) forcible manipulation after injuries.

In the early stages of those cases in which no preliminary injury can be determined, and in which the distribution of the pain follows no definite pattern, the general practitioner is confronted with such a confusion of symptoms that he may overlook the true nature of the case and be inclined to regard the condition as a "compensation neurosis".

Symptoms and Signs.

In the early stage, the shoulder-hand syndrome is characterized by a constant violent pain of a burning nature. The limb still feels warm and dry, and oedema and muscular spasticity are present. Oscillometric studies show an increased blood flow.

If active physiotherapeutic measures are not applied, the condition merges into the second stage, in which periarterial oedema spreads. The limb now feels cold and is hard and cyanotic. Joint stiffness and muscular wasting occur. Radiological examination reveals patchy bony atrophy.

Failure to recognize the condition and to apply the appropriate treatment at this stage results in irreversible trophic changes of the third stage, involving progressive atrophy of skin, muscles and bones with joint ankylosis. Pain becomes uncontrollable and cure is doubtful.

Treatment.

Early treatment is most important. The site of the trauma should be immobilized and thoroughly infiltrated with 1% procaine solution.

In early cases presenting only swelling, oedema and pain of a tolerable degree and normal radiological appearances, physical therapy in the form of mild exercises, lukewarm baths, elevation of the arm and gentle massage, will relieve the condition. In some of the advanced cases, heat aggravates the condition. Steinbrocker recommends repeated sympathetic blocks as a therapeutic procedure and also as a therapeutic test for selection of patients likely to respond to cervical sympathectomy.

Recently, tetra-ethyl ammonium chloride, which produces a blockade of the autonomic ganglia, has also been

used with some success; but this method is still in the experimental stage.

Technique of Paravertebral Sympathetic Block Anaesthesia.—The stellate ganglion is a large club-shaped ganglion two centimetres in length lying in front of the transverse process of the first thoracic vertebra and the head of the first rib between the dome of the pleura and the ligaments covering the rib. Although the technique of posterior approach is used, I prefer the anterior technique advocated by Gillmor and Bates at a site at the level of the cricoid cartilage in the angle between the trachea medially and the sterno-cleido-mastoid muscle laterally; the fingers are pressed inward toward the anterior aspect of the vertebrae, just below and medial to the anterior tubercle of the transverse process of the sixth cervical vertebra. After skin sterilization, a 24-gauge needle two and a half inches in length is passed directly inward and backward until the vertebral body is felt, at the level of the seventh cervical and first thoracic vertebrae; at that site the two ganglia fuse to form the stellate ganglion. A small amount of 2% procaine solution is injected. The needle is withdrawn about one centimetre, and five millilitres of 2% procaine solution are injected. A successful injection is followed by Horner's syndrome—namely, enophthalmos, myosis and ptosis. The arm, side of the head and the neck become warm and dry. In cases in which there is a dramatic relief of pain for the duration of the anaesthesia after infiltration of the stellate ganglion, the removal of the ganglion (stelletomy) is indicated as offering prospects of a cure. Lewis holds this view and considers that the P-factor substance is responsible for the symptoms.

PHYSICAL REHABILITATION—A NATIONAL PROBLEM.

In the present post-war era we are now facing the most stupendous problem in rehabilitation which has ever existed in the history of the world. The legacy of war injuries, combined with the ever-increasing number of industrial and traffic accidents, is the largest Australia has ever known, presenting a tremendous task of post-war rehabilitation on a national basis. Rehabilitation includes the employment of physical medicine, psycho-social adjustment and vocational retraining in an attempt to achieve the maximum function and adjustment of the individual and to prepare him physically, mentally, socially and vocationally for the fullest possible life compatible with his abilities and disabilities.

Rehabilitation has been called "the much neglected third phase of medicine". It fills the gap between the customary end-point of medical care and the real necessities of most patients.

Rehabilitation begins when a man is first injured, and ends only when he is completely restored to maximum activity. Within recent years there has been a greater recognition of the necessity for better scientific medical supervision during the convalescent phase of medical care.

The need is great for the establishment of many more community rehabilitation centres. Proper medical supervision during rehabilitation of sick or disabled patients is best provided by physicians who possess prescriptive ability in the growing specialty of physical medicine, which made such a valuable contribution in the treatment and after-care of the disabled of the two world wars.

Rehabilitation of the Physically Handicapped.

The success of the army and air force reconditioning programme during World War II, especially in the United States of America and Great Britain, reopened the eyes of the medical profession to the great saving in manpower which could be achieved by such a coordinated plan.

The recognition of the value of physical medicine during the exigencies of war in expediting convalescence of service personnel has been a powerful factor in stimulating the growth and development of post-war rehabilitation programmes. The ultimate goal of rehabilitation is to achieve the maximum function and adjustment of the individual patient during his convalescence and after-treatment.

In the rehabilitation of the arthritic this is one of the outstanding advances in post-war civilian medical practice,

since one of the greatest difficulties previously has been the tragic lack of facilities in prolonged after-treatment for continuing the progress made in hospital. The basic needs of the physically disabled are three: (i) to walk and to travel; (ii) to care for their daily needs; (iii) to have the maximum use of their hands. The ideal of the future in medicine to be aimed at is that, until a patient has reached his maximum ability in attaining these three objects, he should not be discharged from a hospital.

Unfortunately, owing to shortage of hospital beds and facilities, there are still a large number of patients who, on their discharge from hospital, still fall far short of this goal. Rehabilitation of the amputee, the paraplegic, the arthritic and the quadriplegic are serious problems to be faced.

In the arthritic, for example, the extent of the limitation of movement and muscular weakness must be determined. A daily activity inventory is valuable as a means of teaching the patient to meet the physical demands of his daily existence. At the Bellevue Hospital of Physical Medicine and Rehabilitation in New York City, patients on their admission for treatment are asked 96 questions relating to their daily activity of dressing and undressing, eating and drinking, toilet activities, wheel chair activities, walking, climbing stairs, endurance, elevation and travelling activities *et cetera*. Evaluation of progress whilst they are under treatment is made at weekly staff clinical meetings. It is amazing to see the manner in which many disabled are able to overcome their handicap and disability after a course of systematic training. From a survey of hospital records, it has been estimated that 97% of all the handicapped can be rehabilitated to a point at which they can gain suitable employment and again become useful members of an economic unit.

Therapeutic Exercise.

Therapeutic exercise properly used will increase the functional capacity and hasten recovery and rehabilitation of many patients in general practice and in specialist practice. Therapeutic exercise, which has been described as the cornerstone of physical medicine and rehabilitation, is prescribed for the attaining of one or more of the following objectives: (i) to develop strength; (ii) to improve motion; (iii) to correct deformities; (iv) to prevent deformities; (v) to increase functional capacity; (vi) to hasten rehabilitation.

A useful classification of therapeutic exercise for prescription purposes is as follows: (i) active-assistive, for mobilizing stiff joints and stretching contractures; (ii) active, for maintaining motion, increasing endurance and developing strength; (iii) resistive, for increasing strength and endurance; (iv) passive (relaxed), for preventing contractures and maintaining proprioceptive reflexes in paralysed extremities; (v) reeducative, for retraining weakened muscles in poliomyelitis and other neuro-muscular disorders; (vi) coordinating, for ataxia and incoordination in spastic paralysis, hemiplegia and combined sclerosis; (vii) relaxing, for spasm and muscular tension; (viii) manipulative, and forced movement, to increase motion with or without anaesthesia.

Some of the conditions that can be relieved by a correct programme of therapeutic exercise are the following: (i) arthritis and fibrositis, (ii) soft-tissue trauma, (iii) stiff shoulder, (iv) healing fractures, (v) chronic foot strain, (vi) poliomyelitis, (vii) hemiplegia, (viii) spastic paralysis, (ix) asthma, (x) combined sclerosis.

Rehabilitation in Pernicious Anaemia.

The use of coordinating exercises and vitamin B₁₂ to produce reversal of neurological symptoms in subacute combined degeneration of the spinal cord marks an outstanding advance in therapeutics, and furnishes further evidence of the valuable role of physical medicine in neurology.

Pernicious anaemia patients with early but pronounced neurological involvement have shown good clinical improvement, which, however, is inversely related to the degree of nervous-system involvement prior to treatment with vitamin B₁₂. When neurological involvement has been of long standing, it may have progressed to the stage when damage is largely irreversible.

Exercises to improve muscular coordination are carried out in series with the patient in the recumbent, sitting and erect positions, extending over intervals of two or three weeks until they are gradually mastered. At the beginning the patient may not be able to balance himself on his toes, but needs the whole foot, especially the heel for stability. In introducing balancing and walking exercises to an ataxic type of patient, be careful to look out for signs of fatigue. Encourage the patient to arch his back slightly backward to prevent falling and then walk sideways rather than forward. *Festina lente*. Progress slowly. Guard against the tendency of the patient to walk too fast. In supervising the patient's exercises, avoid letting him balance himself on his toes and encourage him to walk on the entire foot at the outset, with a gait like a duck waddling, until ataxia disappears and further confidence in walking is obtained.

At the Mayo Clinic it was amazing to see how apparently hopelessly ataxic patients, who could maintain erect posture only by pushing a chair in front of them, were eventually rehabilitated into their former employment.

Vitamin B₁₂.

Vitamin B₁₂ per unit of weight is the most effective anti-anæmic substance known in producing hæmatopoietic activity and bone marrow response. Unique in the chemistry of vitamin B₁₂ is the presence of cobalt in its complex molecule. In this respect it is interesting to note that cobalt deficiency has been recognized in cattle and sheep in South Australia.

In severe cases of pernicious anæmia with neurological manifestations, 25 microgrammes may be given once or twice a week. This dose should be repeated at weekly or semi-weekly intervals until a maximum hæmatological and clinical response has been obtained. For a maintenance dose, ten microgrammes at weekly intervals may be adequate.

Recent observations indicate that vitamin B₁₂ and the use of coordinating exercises are effective in the prevention, control or relief of neurological complications in pernicious anæmia. Among the favourable neurological responses reported to date are: (i) disappearance or amelioration of paresthesias, (ii) restoration of vibration and position sense, (iii) return of superficial pain perception, (iv) improvement in tendon reflexes, and (v) ability to walk.

These responses occurred within four days to three months after the institution of vitamin B₁₂ therapy in conjunction with the use of coordinating exercises. Early diagnosis and treatment give the best results. Vitamin B₁₂ is derived from liver and from cultures of *Streptomyces griseus*, and its use in the treatment of the neurological manifestations of pernicious anæmia in conjunction with coordinating exercises produced further evidence of the beneficial results obtained by the cooperation of neurology and physical medicine.

SUMMARY.

In a consideration of recent advances in rheumatology, physical medicine and rehabilitation the following matters have been discussed.

1. Recent observations on rheumatic disease as a national problem, their prevalence and gravity, have been recorded.
2. A plea is made for a national plan to control the greatest scourge of modern civilization.
3. Recent diagnostic, therapeutic and prognostic considerations have been discussed, with special reference to the recent discovery of the effect of cortisone.
4. A résumé of the treatment of rheumatoid arthritis, including therapeutic criteria and measures of proved value in treatment and in the prevention and correction of deformities, has been given.
5. The role of physical medicine in medical practice as a valuable adjunct in the prevention, diagnosis and treatment of disease has been discussed, and a plea is made for its wider recognition, application and teaching.
6. The value of physical medicine is stressed in arthritis and in neurological conditions, with special reference to

its use in intervertebral disk lesions and in the shoulder-hand syndrome.

7. Physical rehabilitation is presented as a national problem, and its value is stressed as "the much neglected third phase of medicine", with special reference to treatment of the physically handicapped.

8. The effectiveness of muscular coordination exercises in conjunction with the administration of vitamin B₁₂ is described in the treatment of early neurological manifestations of pernicious anæmia.

COMMENT.

We are living in an epidemic of chronic disease in an aging population. The expectancy of life is increasing to such an extent that more than 50% of our population in Australia will be beyond the age of forty-five years within the next twenty years. We are gradually becoming a nation of old people. It is a paradoxical situation that, with every medical advance, we increase the problem of physical rehabilitation in chronic disease. Preventive and therapeutic medicine, as the first and second phases of medical care, have made great progress during the past thirty years. Physical medicine and rehabilitation, conceived in adversity and born of necessity, have grown during that period into a dynamic link between physician and patient. In the higher age groups they will make the greater contribution, as the third phase of medical care, towards dealing with the responsibilities and the new medical problems of the future.

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PREVENTIVE ORTHOPÆDICS AND THE PHYSIOTHERAPIST.¹

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My first acquaintance with physiotherapists was in the summer of 1918-1919. In order to increase the numbers available to staff massage departments in military hospitals, the army arranged an abbreviated course of training. The work was abridged so that after one year's study the students were fitted to work under supervision in military hospitals. Those who completed the year had the right, after serving for some years, to complete the course by a second year, and thus qualify for registration. The professor of anatomy, Professor R. J. A. Berry, invited four medical students to give up eight weeks of the long vacation to coaching the short course massage students. To

¹Read at a meeting of the South Australian Branch of the Australian Physiotherapy Association on September 6, 1950, at Adelaide.

each of us, ten students were allotted. We prepared the dissections alone in the mornings and demonstrated the parts prepared to our students during the afternoons. I was interested to learn later that a similar plan of instruction from prepared dissections was that followed in the training of physiotherapists at the Northwestern University at Chicago—the school which trained Jessie L. Stevenson, of whom I will speak later. The experience of the eight weeks was profitable for the demonstrators. The professor and the army regarded it as satisfactory for the students as an introduction to practical work.

When the need for work in military hospitals had ceased, a number of our students completed the course. Among them there have been some outstanding physiotherapists. I suggest that whenever the question of revision of the curriculum arises in Adelaide—and it is a hardy perennial in Victoria—some thought should be given to (a) the advantages of instruction from prepared dissections in the first introduction with anatomy, (b) the advantages of a period of practical work with patients and their muscles between the two periods of instructions in anatomy.

The short course students who returned to the dissecting room after practical work with nerve injuries gained much more from their second period of anatomy than do ordinary students. For medical and physiotherapy students, it is questionable whether the dissecting room alone is the place to learn the action of muscles with understanding of the meaning. Professor F. Wood Jones told me that in an oral examination for the degree of Master of Surgery he had asked a candidate the action of the sterno-cleido-mastoid muscles acting together. The candidate replied that one authority stated they extended the head on the trunk while Cunningham stated that they flexed the head on the trunk, and the matter was obscure. The professor asked: "What do yours do? You have had two for twenty-four years." The candidate was startled at the idea, as my students have been startled when I have asked them which of the hamstring muscles are acting strongly when a person sits with the heels together, toes turned out. A student who has seen a child with paralysis of both sterno-cleido-mastoid muscles lift his head from the bed by pulling on a lock of hair over the forehead would appreciate that paralysis of these muscles means loss of the power to flex the head on the trunk against gravity, for the same child could nod the head forward when standing or sitting erect, gravity being eliminated. Those of you who have cared for patients who have been in respirators appreciate too the action of the sterno-cleido-mastoid muscles in fixing the chest from above, as the abdominal muscles fix it from below, and you realize the handicap the patient suffers in trying to use his intercostal muscles if these two groups of fixation muscles are paralysed.

In the dissecting room it is difficult for the student to appreciate the importance of the intrinsic muscles of the hand. He learns their action by an effort of memory, and the medical student in his fifth year has to recall these vague memories to understand why, in the splinting of a hand of a child with the spastic type of cerebral palsy, the thumb is abducted and away from the palm almost in the same plane, whereas in the case of weakness of the intrinsic muscles of the hand following poliomyelitis the position most often desirable is one in which the thumb is abducted from the palm but in front of and opposed to the plane of the fingers. In the spastic the contraction of the *adductor pollicis* is the danger; while for the child with poliomyelitis protection has to be provided from the contraction of the strong extrinsic muscles—the *abductor pollicis longus* and the *extensor pollicis longus* and *brevis*. Few medical or physiotherapy students in the dissecting room appreciate the handicap to a man whose work demands the use of a long screwdriver on a fine screw when the power of the first dorsal interosseus muscle is reduced.

In Melbourne, there is opportunity for teaching anatomy of muscles on the living. Less than half a mile from the anatomy school is Yooralla Hospital School, where 100 pupils—potential cripples—spend each school day. Some of you have visited Yooralla. The work is a cooperative

effort of three bodies—the Yooralla Committee, the Education Department and the Children's Hospital. Yooralla and the branch of the Children's Hospital at Hampton have been of great value to physiotherapists in Victoria in affording to post-graduates opportunities for instruction in muscle function. I do consider, however, that the burden of teaching an essential part of a physiotherapist's training—the meaning of the action of muscles—should not fall on a senior physiotherapist; that she should not be forced to teach a salaried staff essentials which could be learned during the years of training.

I ask forgiveness for using the story of the short course of 1919 as a peg on which to hang, for your consideration, the suggestion that the instructors in anatomy of muscles to physiotherapists should be persons who can combine demonstrations on the cadaver with demonstrations on normal people and on patients in whom there is residual paralysis following poliomyelitis. Until such arrangements are made there are books which help to bridge the gap between dissections and "living anatomy". R. D. Lockhart (1947) has published a photographic atlas of anatomy. You are familiar with the United States Public Health Bulletin Number 242, "Care During the Recovery Period in Paralytic Poliomyelitis", written by the Kendalls (1938), but you may not all have seen their recent atlas (1949). A copy of this book should be in every physiotherapy department.

We owe a great deal to the Kendalls, who have advanced and made easy the preliminary work of Wilhelmina Wright. Her book, "Muscle Function" (1928), records her observations of what a muscle does rather than what it may do. To Miss Wright, as to us, "Beevor's Croonian Lectures on Muscular Movements and their Representation in the Central Nervous System" (1904) had furnished a basis.

The Kendalls of Baltimore have watched their patients and their paralysed muscles over years. Because their attention to detail in implementing the basic principles has been meticulous, rather than mere lip service, because they have taken time to let the muscles teach them the effects of fatigue and stretching on paralysed muscles, they have not been deflected, as workers in other centres (where interest in after-care has been transient and superficial) have been deflected, by waves of enthusiasm for "short cuts" such as hydrotherapy or "hot packs", and for the present vogue of short-term workers—"let them up early". The Kendalls, as we do, regard this attitude as equivalent to "near enough is good enough". This attitude may be justified if and when the age incidence of poliomyelitis rises to affect only patients aged over fifty years; but those who have followed their patients from infancy to adult life and who are prepared to take infinite trouble to help each person to maximum recovery, demand a higher standard for their work.

In 1925 I renewed my association with physiotherapists. An epidemic of poliomyelitis occurred in Victoria. I had decided to learn more about this disease and its effects, so I spent hours watching Miss Stella Andrew and Miss N. Taylor at work with their plywood boards and pillows. In 1918 W. Colin MacKenzie had published his book, "The Action of Muscles", and these physiotherapists were working out details of his plan to use gravity to grade the task set the muscle. These physiotherapists and Miss Vera Carter became the teachers in muscle reeducation in Victoria. It was not without a struggle that in 1930 muscle reeducation and the care of paralysed people became a part of the curriculum in Victoria, for it introduced a complete change in attitude of members of the profession. The masseuse of the early days tended her patient and used massage. She applied it. What happened to the muscles in the intervals between her "treatment" was not her concern. If improvement occurred, it was regarded as a direct result of the laying on of her hands.

In the same way electrical therapy was regarded early in this century. The late Dr. Alan McKay told me that, as the honorary medical officer in charge of the physiotherapy department at the Children's Hospital, Melbourne, he had been kept busy stimulating paralysed muscles with electricity. His attitude, at that time, was that any recovery was a direct result of his stimulation.

This attitude has changed so completely in the after-care of poliomyelitis, in the care of the cerebral palsied child, in the work with chest patients and those presenting postural defects, that the inclusion of the word "therapy" or "therapist" in the designation of the profession and of many of its members is, to a certain extent, misleading. I am not suggesting any change—kinesiology is no better—but too many lay and medical people are apt to regard the work of the physiotherapist as a mystic healing application. It may be so in the aspect of the work with which I am not familiar, the electrical side—diathermy and short-wave therapy *et cetera*; but the chief responsibility of many physiotherapists today is to act as guides, as teachers to the parents and to the older patients and to those caring for the patients, to instruct them accurately in details of a regime, a mode of life planned to allow Nature's recuperative powers to have every opportunity.

We evade the use of the word "treatment" and use "care" instead. A gardener does not "treat" his lemon tree; he cares for it, protecting it from harmful influences, arranging for conditions he has learned are favourable for the tree's growth and health and its production of good lemons. In the same way the physiotherapist today takes a humble view of her contribution. She acts as an assistant to Nature.

Charles Fayette Taylor, in 1867, when discussing the period of relatively rapid recovery of power following poliomyelitis, explained why, from time to time, various new procedures are hailed as cures. His comments are as sound today as eighty years ago.

All cases tend towards recovery. Very few cases are to be met with where some portion of the originally paralysed members have not entirely recovered. Nature does, with comparative rapidity, what she can, and would often do much more if permitted. Many a theory has been triumphantly established by happening to be tried at a time when nature is sure to be using her reserve force to repair damages and always with more or less success. If the Apostles of "electricity", "movements", "strychnia", and the "ice bag" have no better data than partial recovery in a few cases within the period of first recuperative effort, their claims rest on a very unsatisfactory basis.

I recall one meeting of the Australian Physiotherapy Association in Melbourne, in 1930, at which members of the Children's Hospital staff who were instructing mothers in the care of their paralysed children and the prevention of deformities were taken to task by the seniors. Was it true that these workers were spending their time teaching mothers exercises? Was it true that these unfortunate children were denied massage?

It does not seem very long ago that the important aspect of the preliminary inspection of candidates for the physiotherapy course was an examination by a doctor of the candidate's hands to determine whether they would be suitable for massage. In such an examination nowadays and for the future, I would suggest an estimation of the candidate's eye for alignment. Can she detect the beginning of deformity or must she rely on plumb-lines, spirit-levels, compass points and set-squares to determine a deviation from normal form?

In a second aspect, the work with paralysis following poliomyelitis has caused a fundamental change in the ambit of the physiotherapist—namely, interest in and responsibility for details of accurate splinting. In 1925 parents carried or brought their children in long perambulators to the Children's Hospital, Melbourne. The masseuse took the patient to her cubicle and applied the massage, and the patient went home. The deformities which occurred were regarded as inevitable. Splinting, if any, was the doctor's responsibility. In 1927, when I became responsible for the physiotherapy department, there was little money available for staff, and it soon became obvious that it was a waste of public money, parents' energy and physiotherapists' time, for this session to be held in a cubicle two or three times weekly, unless effective measures were taken synchronously to protect the paralysed muscles from fatigue

and stretching and to anticipate deformity twenty-four hours each day.

In the days of Robert Lovett at the Children's Hospital in Boston, he had on the wall of his department a large notice asking three questions: "What are you trying to do? Is it worth doing? Are you doing it?" I read these questions in 1929, and have tried to answer them honestly in regard to every patient I have cared for since. If the answers are considered in relation to the care of paralysed persons as out-patients, experience taught that the answer to the second question, "Is it worth doing?", was in the negative, except for patients whose paralysis was limited to muscles of the upper limb below the elbow, and for a small number of infants living near the hospital whose mothers could, without fatigue or strain, convey them for instruction from a physiotherapist who had ample time to teach them. Without the opportunity for quiet unhurried instruction of the mothers in the details of the care during the hours at home, and splinting, perfected in its detail for the requirement of each individual patient, time spent by a physiotherapist becomes a gesture, a token, a pretence at after-care of poliomyelitis.

As a result of this evaluation, in 1930 the committee of the Children's Hospital, Melbourne, established the itinerant physiotherapy service, bringing to the mother in the home a guide and instructor, called a physiotherapist, who checked the splinting and coached her in the details of a regime planned to help her child.

The itinerant service of the physiotherapy department of the Children's Hospital, Melbourne, has functioned without intermission for almost twenty years. Originally three full-time physiotherapists were provided. The numbers increased to the equivalent of more than 60 full-time people during the after-care following the epidemic of 1937-1938. At present, 28 persons, the equivalent of 13 full-time physiotherapists, are caring for 362 children in their homes in the metropolis. Years have taught us that a mother can learn more readily in the quietness of her home than when bustling and rushed after a journey to the out-patient department, even if transport is provided. The physiotherapist can check the bed or perambulator used by the child and the suitability of chairs, tables *et cetera*, which he uses. The mothers and fathers are coopted as members of a team. They quickly learn the principles and the details of care required to give their child a chance. When many new patients demand care from the staff, the parents of those paralysed earlier are competent to handle their child with supervision at longer intervals from the physiotherapist—once weekly, fortnightly, or monthly.

The provision in Melbourne of a comparable service to paralysed persons older than fourteen years—the age limit of the Children's Hospital—means recognition by the Consultative Council for Poliomyelitis of the fact that the fatigue involved in transport of an adult with paralysis of muscles of the trunk or lower limbs to an out-patient department for physiotherapy defeats the purpose, if improvement of the patient's muscular power is the purpose. For example, I recall one young man with severe calf weakness and moderate quadriceps weakness who limped over hilly country two miles to a railway station, travelled 30 miles in a train, then took a tram to the hospital, on three occasions each week in order to have twenty minutes' physiotherapy. This session would need to have had miraculous powers—and I use the word "miraculous" accurately and deliberately—to balance the flogging of his muscles by the effort involved in travelling to the hospital.

The salvage of the potential cripple will be accelerated when lay people realize that there are two subdivisions in the profession of physiotherapy: (i) that in which the patient is the passive recipient of therapy—the electrical side; (ii) that in which the physiotherapist is a technician in conservative orthopaedics and preventive orthopaedics. She acts as a pilot or instructor in details of a regime, steering her patient from deformity, guiding him and his parents in the way to help him grow up straight and efficient. I would remind you that in 1743 André used the word "orthopædia" to describe the art of helping children to grow up straight.

Recently, interest has awakened in the care of the cerebral palsied child. Centres have been established. To be effective, the regime in the pre-school room should be developed by a pre-school teacher who acts under the constant guidance of the physiotherapist in charge.

Lay committees are apt to regard the physiotherapist for such a centre as a person working in a water-tight compartment, whither the children are taken to have applied some magic healing. It is hard for them to realize that the work of the physiotherapist can be cancelled out and the child's condition deteriorate if the pre-school teacher alone determines his activities in her school room. All the physiotherapist's efforts to help the athetoid child with tension to relax are wasted if, on his return to the classroom, the teacher urges Johnny to concentrate on putting a round peg in a round hole, to use the muscles of his hands for fine movements before he has easy control of shoulder and elbow movements.

The doctor, and the physiotherapist to whom he delegates responsibility for details, are the people who should determine the activities at home and in the classroom of the pre-school children with cerebral palsy. At Yooralla and at Hampton we have been fortunate in the cooperation of the Education Department teachers, who have accepted without question the principle that the physiotherapist guides activities to promote physical improvement of the children who attend. Without this appreciation such centres will not make the contribution possible to the cerebral palsied child.

In one aspect the physiotherapist's place as a technician in orthopaedics is realized, even by lay people. Within the past twenty years many details for accurate splinting have become her responsibility. In this field I think Sydney pioneered the way in the early instruction in the use of plaster, the taking of casts, and the making of hand splints, plaster bed boots and modified gloves.

Now our senior physiotherapists are responsible for the modifications of splints, for their lengthening, and for seeing that the splint is effective in its purpose. In many country districts the physiotherapist has been the only person between the patient and deformity. She has had to take the responsibility of measuring and fitting appliances, and on occasions of instructing local craftsmen in their production.

I have spent considerable time in outlining the alteration of the ambit of the physiotherapist in the past twenty-five years. You will understand that I am limiting my remarks to the work I know, and that I leave it to someone else to discuss developments in the electrical or palliative as opposed to the preventive or orthopaedic field.

I have lingered on the transition from the masseuse to the technician in orthopaedics because to me it appears that the writing is on the wall. It is in this field of preventing crippling and salvaging the potential cripple that the majority of the physiotherapists of 1960 will find their fulfilment. A small yellow book was published in 1925 by the Central Council for the Care of the Cripples of England. It was written by Mr. Gawthorne Girdlestone, on whom the mantle of Sir Robert Jones has since descended. To this book I owe two phrases, which like the phrase "position habitually assumed" have been used so frequently in Victoria that it is a pleasure to try them out on a new audience: "potential cripple" and "the cripple factory". Some of Mr. Girdlestone's sentences you know. "The cripple is made—not born." "This is the rule and the making is usually a long affair." "The manufacturing process is slow, but as a rule quite effective if there is no interference with the machinery." "The normal child goes in at one end of the factory and is submitted to one or other of the various processes which, in months or years, produce the finished cripple." "Interference with the process is the more decisive the earlier we come to the rescue of these children and stop the machinery." "The child with the congenital defect, uncared for, unless quickly rescued is put through the mill with the other children, growth and unbalanced muscular action multiplying the original deformity."

"There is no disease which demands orthopaedic care with such imperative urgency as poliomyelitis."

These sentences of Mr. Girdlestone's provided my stimulus in attempting to arrange for after-care of paralysed children in Victoria.

The simile of the factory applies as truly for the child with cerebral palsy. The damage to nerve cells wrought by the lesion should be the final handicap; but, uncared for, these babies are further handicapped by unnecessary deformities, dislocated hips, years of idleness—mental and physical. Interference with the crippling factory is a time-consuming business. Attention to detail, guidance of parents, must be repeated and long-continued if the crippling processes are to be arrested.

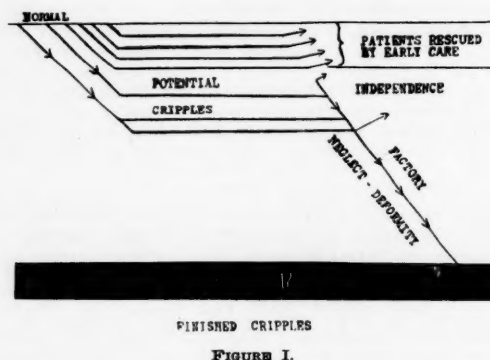


FIGURE I.

Figure I illustrates the difference between the place of orthopaedics as originally practised—the attempt to make over or bring back the finished cripple who has passed throughout the factory—and preventive orthopaedics—early interference in the crippling processes. It illustrates, too, the contrast between the sphere of work of the physiotherapist—early, anticipating deformity, rescuing from the cripple factory on the one hand—and, at the other extreme, rehabilitation services endeavouring to teach special trades to the finished products turned out by the factory.

It is good that, in Adelaide, the society called the Crippled Children's Association of South Australia, despite its name, is active in the salvage of the potential cripple, rather than withholding interest and help until crippling processes are complete. Governments have not yet realized how fantastic it is to spend large sums of money on attempts to rehabilitate the finished cripple and at the same time be parsimonious in providing funds to bodies working (a) to detect the potential cripple early, (b) to rescue him from the factory—by early, skilled and long-continued care.

Even lay committees find it hard to grasp that, in the care of cerebral palsied children, from a national viewpoint, first priority of care should be given to the babies and toddlers. The need for expensive centres and schools for older "spastic" children will increase if priority of care is given to older children who have spent years in the cripple factory, while at the same time the babies, whose parents are less vocal in demanding care, are busy manufacturing needless deformities which will enable them to qualify for admission to special schools.

The objectives for the future should be: (i) research into aetiology and (ii) reduction of the factors already known to be the cause of cerebral palsy; (iii) recognition in infancy; (iv) care in infancy and the pre-school years, aimed at attendance at the age of six years for those who can benefit by education at a school for ordinary children.

When governments appreciate the economy of preventive orthopaedics, the people most needed to do the rescuing from the factory which manufactures crippling, deformity and dependence will be physiotherapists. As yet relatively few doctors in this country are interested, though the Aus-

tralian Orthopaedic Association recognizes the place of preventive orthopaedics in the second clause of its constitution: "To act, advise and co-operate in the prevention of crippling diseases." The author of "Menders of the Maimed", Sir Arthur Keith, when discussing the correction of knock-knees by osteotomy, made the following statement:

The true criterion for measuring the standard of surgery in any country is not the success of operative treatment, but the success which has been attained in its prevention. . . . I am persuaded if our Modern British School of Surgery has a defect, it is a tendency to remain satisfied with success in operation. We must do more. We must dig beneath the surface of current knowledge and try to discover the true cause of the disease or deformity.

For any doctor with the temperament of a gardener, who enjoys growing walnut trees rather than short-term crops, conservative orthopaedics offers a satisfying field. Doctors are needed to work with physiotherapists, to battle for them, to arrange for supply of necessary equipment, and to plan and guide; but physiotherapists have proven the value of their contribution.

This work has advanced in Victoria recently. In the four years since the Consultative Council for Poliomyelitis was appointed, the consultant service for the after-care of poliomyelitis in base hospitals in the country has been established; two full-time medical officers for poliomyelitis have been appointed to the Department of Health; authority has been obtained to appoint ten full-time physiotherapists to the Department of Health to care for paralysed persons aged over fourteen years in the city and for children and adults in country areas other than those served by a base hospital employing a physiotherapist.

Five full-time workers have already been appointed. Miss Marjorie Farnbach has given up her position as chief of the itinerant service of the Children's Hospital to become physiotherapist in charge of the State-wide health department service, to recruit and train a staff comparable to that she handled for the metropolitan children.

The appointment of experienced physiotherapists to the staff of base hospitals in country districts of Victoria has proved that a great deal of the after-care of poliomyelitis in country people can be handled locally, and that visits of consultant orthopaedists become effective when there is some one in the district to implement the details of care advised. In this branch, several male physiotherapists have found interesting and worth-while work.

In Victoria, medical inspection of State school children is now a function of the Department of Health. In country districts this has resulted in reference to the base hospitals of "missed cases" of poliomyelitis, of children with mild degrees of cerebral palsy, and of children with postural defects, all of whom the physiotherapist can guide in a regime to grow up straight.

You may say that all this is just a development of work already being done, comparable to that arranged in England in Shropshire, and around Oxford, twenty-five years ago, but modified to Victorian conditions, physiotherapists being used instead of orthopaedic nurses, for the reason that, in Victoria, poliomyelitis, cerebral palsy and postural defects are major causes of crippling, whereas in England, tuberculosis of bone and joint, rickets and injuries were more important. This comment is justified; but in both places there is much work to be done before we have attained the ideal as laid down by Mr. Girdlestone—"to cast over the country a network fine enough to ensure that none shall fall through the holes of ignorance, poverty or apathy into an unnecessary crippling and deformity". Of these, ignorance is the most important.

There are several other fields of usefulness waiting for physiotherapists. Patients suffering from disseminated sclerosis have organized to form an association and are seeking help and guidance to prolong their period of active useful life. They can see no reason, nor can I, why funds should be raised by public subscription to send a few patients to the United States when we have physiotherapists in Australia able to contribute equivalent help.

Physicians interested in the care of the children and adults suffering from respiratory disorders, such as asthma, bronchitis, sinusitis and bronchiectasis, regard the help of the physiotherapist trained in chest work as an effective means of improving their patients, for, as in the care of poliomyelitis patients, she teaches the patient how to correct respiratory function, how to improve his general physique.

You may wonder why this article has been called preventive orthopaedics while every subject so far discussed is the result of some disease or disorder, and the patients are those commonly seen at hospitals. The word "preventive" has been chosen in preference to "conservative", because I believe that the physiotherapist who has become a technician in conservative orthopaedics will dig deeper and become the key person in preventing the basic causes of crippling, poor physique, poor posture, knock-knees and flat feet.

In the summer of 1948-1949 it was my privilege to become involved in the work of the Lord Mayor's Camp for Country Children held at Portsea. Between November and May nearly 3000 rural children were carefully examined at the camp. The results of these examinations, together with those from the camp of the preceding summer, shook from complacency many of us who had spent our working lives near hospitals. "All is not well with the country child" was the conclusion.

While evidence of disease of organs was relatively uncommon, the condition of the teeth appalled the dentists who gave their services, and the early stages of crippling conditions due to "chassis" troubles were rife. Knock-knees, flat feet, kypholordosis, scoliosis and torticollis were so common that the physiotherapists who made the preliminary examination of all children used to bring in a child who had had poliomyelitis to cheer us up by the sight of a child who knew how to stand erect.

The Premier, Mr. Hollway, and the Minister of Health, Mr. C. P. Gartside, were invited to Portsea and shown many of the children—their poor chest expansion, curved backs, knock-knees, flat feet. The Minister of Health asked for a plan to tackle the basic causes of the poor physique—the commencing crippling deformities.

It was appreciated that nutrition is a real factor; but ignorance on the part of the parents of the simple measures needed to provide good nutrition and promote good posture is the primary cause. Dissemination of knowledge is needed. The first suggestion made to the Minister was as follows: Over Victoria a network has been spread primarily to reduce infant mortality. The Infant Welfare Service, by its centres, its mobile caravan and its correspondence section, takes care of the "engine" of the babies and the strength of the mixtures fed to them. The sisters realize their lack of training in the care of the "chassis".

It was suggested and approved by the Minister of Health that a staff of physiotherapists should be employed by the Division of Maternal and Child Hygiene, some full-time, some on a sessional basis, (a) to teach the mothers antenatal and post-natal exercises, as sponsored by Dr. Dick Read and taught by Miss Helen Heardman, (b) at the same time to interest the fathers and mothers-to-be in the "chassis" and posture of their children, and (c) to work in infant welfare centres and kindergartens detecting early stages of deformity, teaching the mothers and kindergarten workers how to help the children grow up straight.

In California a physiotherapist, Mrs. Mabel Fitzhugh, has developed this work. She has written two booklets, "Straight from the Start" and "Let's Keep Them Straight". It may be possible to bring Mrs. Fitzhugh to Australia to train other physiotherapists to inaugurate this service and thus stimulate the interest of the health centre sisters and kindergarten teachers in the "chassis" of the children. I believe that if Madame Montessori had had any eye for alignment, the incidence of knock-knees and poor posture would have been substantially reduced, because of the opportunities offered in kindergartens for guidance of the parents. The army figures for rejection of recruits

prove how many do not "grow out" of the postural defects of childhood.

The detection of some congenital deformities is prompt. *Talipes equinovarus* is recognized and dealt with early; but treatment of *talipes calcaneus* or *talipes calcaneo-valgus* is often delayed until the child has failed to stand and walk early in his second year. Many women-power hours will be saved when the health centre sisters are guided by physiotherapists trained to use their eyes for alignment, for the care of a child with a *talipes valgus* or *talipes calcaneus* is easy, and correction is rapid if treatment is commenced soon after birth.

I have wondered why so few Australian physiotherapists record their methods. I know only two who have done so. Miss Honor Wilson published an article on "The Place of Physiotherapy in Plastic Surgery" in the *Physiotherapy Review*. Mrs. Davison (Miss Lois Bain) published in THE MEDICAL JOURNAL OF AUSTRALIA an article on the after-care of poliomyelitis in Adelaide.

The decision of the Federal Council of the Australian Physiotherapy Association to have an Australian publication for physiotherapists will provide the stimulus for the future. In the United States, Miss Jessie L. Stevenson has published three valuable books: "Posture and Nursing", "Orthopaedic Condition at Birth", "Care of Poliomyelitis". Copies of the first and second of these can be obtained with many other abstracts and pamphlets from the Joint Orthopaedic Nursing Advisory Service, 1790 Broadway, New York City, New York. From the same source I obtained "The Contribution of Physiotherapy to Nursing Education" (1948). In this book another field for the physiotherapist is outlined—preventive orthopaedics again—instruction to the tutor sisters in the training of nurses in body mechanics. The plan aims at reminding nurses that along with their care of the "engine", the "chassis" too needs care.

In certain hospitals a great deal of time is spent teaching trainee nurses how to use their muscles so that fatigue is reduced. For male physiotherapists, opportunities will increase when insurance companies learn that absenteeism from back-strain will be reduced when workmen engaged on heavy work receive instruction on lifting, using the big thigh muscles, guarding the lower part of the back. The Department of Labour and Industry of New South Wales has some activity in this field of preventive orthopaedics. A good poster showing the right and the wrong way to lift is available on application. It will not be long before organizations which employ men engaged in long periods of standing and walking seek the advice of orthopaedist and physiotherapist to explain to their personnel the care needed to meet long-continued efforts of certain muscles.

Conclusion.

While in the past the work of the physiotherapist has been closely associated with hospitals and with people hurt by disease or injury, it appears that a field of usefulness just as wide, and if anything more important, is waiting among people who are supposed to be well—in the infant welfare centres, the kindergartens, the schools and industry. In this field, physiotherapists will "teach" rather than "treat"; use eyes more than hands; become more articulate and play a part in improving the physique of the people—a part for which the basic training for physiotherapy could equip its graduates to contribute more than does that of any other medical ancillary service.

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SOME OBSERVATIONS ON UNDERGRADUATE TRAINING IN OBSTETRICS AND GYNÆCOLOGY.

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THE recent seventh session of the Australasian Medical Congress (British Medical Association) held at Brisbane served incidentally as a reminder of the existence of a young medical school in that city.

It has been suggested that there may, as a consequence, be an interest in some quarters in our experience of building up a new school, in what we are thinking about current problems of medical education, and in what we are doing about them. Such an account would, of course, cover too wide a field to be included in a single article. The alternative appeared to be to deal separately with different aspects of purely clinical training, subsequently reviewing briefly the whole curriculum in the light of earlier observations. This contribution, then, deals with undergraduate training in obstetrics and gynaecology.

In the planning and implementing of the course in obstetrics and gynaecology at the Queensland medical school, certain objectives have been borne in mind. Whilst the mere reaffirmation of these principles may savour rather of platitudes and of only partially-practicable ideals, their critical reexamination may prove worth while. It seems reasonable also to assume that those who read articles such as this have an interest in at least some aspect of medical education, whether in obstetrics and gynaecology or in some other sphere.

These principles may (in spite of a certain amount of overlapping) be set out as follows: (i) To create at the undergraduate level a genuine and lasting interest in obstetrics, not only as a science, but as an art, and to foster such latent idealism as may exist. (ii) To provide reasonable opportunity for students to acquire the rudiments of a sound obstetric judgement. (iii) To provide the means whereby the student may acquire, before graduation, certain technical skills in this field. (iv) To persuade students to think about obstetrical problems. (v) To implant the idea that obstetrics is essentially preventive rather than remedial. (vi) To produce graduates who are interested in and reasonably well-informed about problems of infant feeding and neonatal care generally. (vii) To create in the students' minds an appreciation of the essential unity of the two subjects, obstetrics and gynaecology. (viii) To provide a sound basis for the proper appreciation and interpretation of gynaecological symptoms. (ix) To bring students into contact with the type of gynaecological disorders most likely to be encountered in general practice.

The staff of the department consists of a half-time professor of obstetrics, who is also administrative head of the department of gynaecology, and who undertakes some aspects of the teaching of that subject, a half-time first assistant to the professor, a teaching registrar in obstetrics and a teaching registrar in gynaecology. These four comprise the professorial unit; there are, in addition, the lecturer in clinical gynaecology, the usual clinical lecturers and tutors, a lecturer in diseases of the newborn and another dealing with mothercraft and infant feeding. The last-mentioned lecturers, of course, are all part-time; the professor gives his afternoons to the university and the first assistant his mornings. The positions of teaching registrar are full-time and resident; the appointment is made conjointly by the university and the Hospitals Board and the term of appointment is for two years.

The clinical material available comes from the public section of the Brisbane Women's Hospital, the adjacent gynaecological wards and out-patient department of the Brisbane General Hospital, and those infant welfare clinics within a convenient distance of the Women's Hospital.

At the moment the didactic lectures in obstetrics (of which there are 36) are given during the last two terms of the fourth academic year, and the didactic lectures in

gynaecology (of which there are 25) are given during the first term of the fifth year. Certain changes in the timing of these lectures are referred to later. Each student devotes one term of his fifth year to clinical obstetrics and gynaecology (including four weeks in residence), and is engaged for a further three weeks (wholly resident) during his sixth year in a "refresher course" in these subjects.

Throughout the clinical part of the course obstetrics and gynaecology are taught concurrently.

Under the new curriculum at the Queensland school students will still devote one term to clinical work in these subjects during their fifth year, but with a shorter period in actual residence. The sixth year of the new curriculum will probably be entirely free of didactic lectures in any subject, and students will devote ten weeks to obstetrics and gynaecology with five weeks in residence. (The exact content of the final year of the new curriculum is still under discussion.)

With this somewhat sketchy background it may be worth while to consider briefly those measures which have been evolved during the last twelve years in an endeavour to carry into practice some of the desiderata referred to, and at the same time to make certain general observations.

I. To Create an Interest in Obstetrics as a Science and as an Art.

Because the opportunity to conduct confinements themselves, under supervision, is often the students' first taste of actually practising the art of medicine, they often display considerable keenness during their practical training in obstetrics. This keenness, however, tends to fade; it has too much of the element of novelty, and should not be confused with the "genuine and lasting interest" which is sought. The test of the latter is that the student, as a graduate in general practice ten or fifteen years later, shall still enjoy carrying out the obstetrical work of his practice, and that its "nuisance value" as a disturber of rest and routine shall still be offset by the enduring satisfaction that it brings.

First impressions are important and lasting, and there is little doubt that the main function of a course of didactic lectures in obstetrics in these days of well-illustrated textbooks is to arouse a lively interest rather than to attempt a systematized coverage of the subject. Contrary to popular opinion, students' minds can be diverted without undue difficulty from the next examination or the coming vacation; and in the student with a sense of vocation a sympathetic and stimulating introduction to a subject such as obstetrics can do much to sow the seeds of a lifelong interest in this aspect of his work.

There is reason to believe also that there is a latent idealism in many undergraduates at the stage of their early clinical training, to which we should appeal.

Students tend to take a lead from their tutors and clinical lecturers in the type of approach to and handling of patients in the wards and out-patient clinics, and the force of example is probably a determining factor in this regard. Nevertheless the didactic lecture also offers valuable opportunities to foster the conception that the element of personal responsibility and personal interest implied in undertaking obstetric cases should be paramount and overriding, and that, if carried out in this spirit, the work, though demanding, has its compensations, intangible yet satisfying.

Incidentally, there is a growing conviction that, apart from some instruction in inter-professional relationships, medical ethics should not be presented to undergraduates as a separate short course of lectures but closely interwoven into the general pattern of teaching as each new clinical subject is introduced.

The timing of the main lecture course in obstetrics is important; the commencement of practical work at the beginning of the fifth academic year has usually meant completing the lecture course by the end of the fourth year. Because this involves an interval of eight or nine

months before the last group of students commence their practical work, it is proposed to give an introductory course of lectures, of sufficient content, in the last term of fourth year, and to deal with the less commonly encountered abnormalities during the first term of the fifth year, even though one group may have commenced their hospital work.

II. To Provide the Means Whereby Students may Acquire the Rudiments of a Sound Obstetric Judgement.

A realistic attitude towards the second objective lays emphasis, of course, on the word "rudiments", since the acquisition of a good obstetric judgement may well extend over many years. Some, by reason of temperament or because of failure to benefit by experience, will never acquire a really good judgement. At the undergraduate level students must come to appreciate that it is not so much "how" but "when" to act along this line or that. The "how" can be readily mastered by the student or resident medical officer of average intelligence and manual dexterity; the "when" calls for qualities of application, patience, resourcefulness and an ability to profit by past mistakes.

The basis of a good obstetric judgement is more likely to be established in the student who carefully follows a limited number of patients through the latter weeks of their pregnancy, their labour and puerperium, than in the allegedly keen student who is constantly "in at the finish" of unusual cases but who neglects opportunities to observe closely any one patient from the beginning to the end of parturition.

This habit of careful observation forms the basis of a sound judgement and has to be enforced, since the average student usually belongs to the latter category. Case records and commentaries, submitted before the final examination, should bear evidence of regular attendance and clinical observation during the course of labour. A definite degree of responsibility delegated to students by the labour ward sister to watch patients in labour and to report progress gives them an added incentive to do the job thoroughly. Under the new arrangements for the sixth year, this aspect of students' work will be undisturbed by lectures or other formal classes.

III. To Provide the Means Whereby the Student may Acquire Certain Technical Skills.

The relative importance of the third objective tends to be over-emphasized, especially by students themselves. Obviously the "average student" will require to conduct a certain minimum number of confinements under supervision before acquiring the necessary "touch" and manual dexterity to permit him to practise independently. But, because of the competition these days between medical students and nursing trainees to "get their cases", the acquisition of purely technical skill tends to loom too prominently in the over-all plan of undergraduate instruction in obstetrics.

There are few students who cannot conduct a normal confinement skilfully after ten cases dealt with under supervision, and it would save a great deal of trouble if we could be content with this figure. Our feeling, however, is that a student is just "feeling his feet" after ten cases and that his judgement (immature as it is) tends to develop much more rapidly if he can closely observe and confine another three or four patients.

It has been possible thus far at the Queensland school to ensure an average of 14 confinements for each student. This figure may suffer some reduction in the next few years, but it has been brought about by a number of expedients including the principle of the "priority week" for each group in residence. During this week all normal public patients in labour are, by courtesy of the hospital authorities, allotted to students, thus offsetting the equivalent number of weeks in each year occupied by vacations and examination times, when all such patients inevitably are allotted to trainee nurses.

In common with other teaching centres, only a small proportion of all graduates will each year obtain a resident post at an obstetric hospital. Because of this and because of the considerable number of "one-man towns" in Queensland, we have attempted as in other schools to carry the technical aspect of student training in obstetrics a little further than personal experience in the conduct of normal confinements. It has recently been possible to ensure that each final-year student applies obstetric forceps at least once, and it is intended to extend this type of supervised instruction to include external version, episiotomy, perineal suture, transfusion work and, for the group attached to the gynaecological unit, curettage of the uterus.

The recent improvement in teaching models has made "dummy drill" a worthwhile procedure in any teaching programme, and all the recognized manipulative procedures are effectively rehearsed by final-year students in this way. This, of course, has to be done in small groups, and involves much repetition for those members of the staff supervising these classes, but it appears to be worth the effort involved.

Instruction in the technical side of obstetric training lends itself to the use of visual aids in the form of suitable cinematographic films, and we have been able to build up a small but representative film library demonstrating, in recently produced films, such techniques as manual rotation of the occiput, forceps application, breech delivery, induction of labour, Caesarean section *et cetera*.

These films are not used as part of the main lecture course, but are shown several times a year—that is, to each group of students during their fifth-year term in obstetrics. Ideally, the appropriate film would be shown just prior to, or after, the management of an actual case in the labour ward or operating theatre. We hope to achieve this.

IV. To Persuade Students to Think About Obstetrical Problems.

Students on the whole are inclined to prefer dogmatic statements and are only too ready to assign factual information into watertight compartments. But especially in obstetrics they must learn to weigh issues and to interpret their text-book reading in terms of clinical reality. The hypothetical or actual case history is a most useful instrument of teaching in this regard, and Professor B. T. Mayes's recent book, "Practical Obstetrics", was deservedly popular because it introduced at once this atmosphere of clinical reality into the printed page; Beaumont in his new volume "Applied Medicine", has used the same teaching technique.

Whilst bringing their knowledge of physiology, biochemistry and bacteriology to bear on obstetric problems, students must learn at the same time (not five or ten years later) to consider the possible bearing of such factors as the patient's domestic and educational background or emotional reactions on the particular problem under discussion. This ability develops more rapidly in the mature student, but cannot be left unnurtured in the immature.

The obstetric department of the Queensland school has endeavoured to create the incentive for students to think about their work by including in the programme for each group attending the Women's Hospital a series of seminars or round-table discussions on a pre-selected topic, preferably relating to obstetric conditions recently encountered. Three such seminars are held each week and the students themselves are the principal contributors. Every encouragement is given to make the discussion a critical one, and students appear to enjoy the mental exercise of weighing pros and cons under experienced guidance. Of course, these seminars do not always work out as they were intended, and if the tendency is not checked students tend to use them simply as revision classes. Much depends on the skill with which the seminars are conducted by the clinical teacher.

V. To Implant the Idea that Good Obstetrics is Essentially Preventive Rather than Remedial.

It takes time for the average medical student to appreciate that for the most part an experienced obstetrician "keeps out of trouble". His introduction to the science

and art of obstetrics usually takes place in a busy metropolitan obstetric hospital, where emergency admissions are a daily occurrence and complicated deliveries not infrequent.

His teachers must see to it that a student's interest in the treatment of an eclamptic patient is offset by an equally keen interest in the less dramatic measures which serve to minimize the incidence of severe pregnancy toxæmias. The amazing powers of recovery after blood transfusion of a recently-admitted patient, exsanguinated by ante-partum hæmorrhage, will impress the most casual student; but he must be no less impressed with the unwisdom of performing a vaginal examination, in the home, on a patient suspected of *placenta prævia*.

The ease with which such examples can be multiplied justifies, perhaps, the inclusion of this principle, however trite and obvious it may appear at first sight. Simply, it amounts to this: students must come to develop a proper sense of values in terms of their obstetric work. Just how to achieve this is not quite so simple—much will depend on the way in which the preventive aspect of obstetrics is presented to them. Teaching in the antenatal clinics should be made as attractive as possible. On the other hand, student instruction in the labour ward or operating theatre following the management of a complicated obstetric case should ideally always end on a note of prevention. "Debunking" the dramatic in obstetrics is often worth while when one is dealing with an impressionable group of students.

VI. To Produce Graduates who are Interested in and Well Informed about Problems of Infant Feeding.

It is notoriously difficult to make students really interested in the many small problems associated with mothercraft and infant feeding. Exceptions to this have been observed in married students, often ex-servicemen, who have young families of their own, and this fact probably gives a clue to the difficulty—namely, the need to present students with these problems at first hand. Didactic lectures and nursery demonstrations are not enough; even group visits (10 to 15 students) to infant welfare centres may not bring home to individual students the importance of a full understanding of this aspect of their work, especially as it will apply during their early years in general practice.

For this reason it is proposed (with the cooperation of the appropriate authorities) that during their re-planned sixth year students shall regularly attend, in groups of two or three, one of the many infant welfare clinics scattered around the city and the closer suburbs. There it is proposed they will themselves interview the mothers, recording the relevant facts which they will then pass on to the attending medical officer or clinic sister, who will, in the hearing of the student concerned, deal appropriately with the situation. Any one student will probably make ten consecutive weekly visits to the same centre, which will enable him to follow up individual infant problems. Students will still receive instruction during their fifth year in the basic principles of mothercraft and infant feeding, thus acquiring the necessary background for their "field work" at the baby clinics during their sixth year.

VII. To Create in the Students' Minds an Appreciation of the Essential Unity of the Two Subjects, Obstetrics and Gynaecology.

As in many other clinical schools, we are of the opinion that those twin subjects, obstetrics and gynaecology, are best taught concurrently. Apart from the fact that pregnancy (whether intrauterine or extrauterine) enters into the differential diagnosis of a number of gynaecological conditions, it is well that students should appreciate the extent to which many gynaecological lesions represent the aftermath of infection or injury acquired during the process of miscarriage or parturition. Just as the teaching in relation to complicated obstetric cases should end on the note of prevention, so should gynaecological teaching incorporate and stress the theme of good obstetrics (including proper post-natal care) as a major preventive factor in

relation to gynaecological disorders. But for this it is desirable that the student should be seeing both obstetric and gynaecological patients at the same time.

The soundness of these ideas is usually readily acknowledged; Munro Kerr sets them out very well in the preface to the first edition of his combined text-book of obstetrics and gynaecology (1923), and the Royal College of Obstetricians and Gynaecologists loses no opportunity to stress the essential indivisibility of the two subjects whether in relation to precept or to practice. There is less evidence that, by and large, as far as they relate to teaching, these ideas are being given anything more than lip service, and we feel that to conduct the clinical teaching in obstetrics and gynaecology concurrently at least provides the clinical teachers with the opportunities for something more.

VIII. To Provide a Sound Basis for the Proper Appreciation and Interpretation of Gynaecological Symptoms.

There is little need to elaborate the eighth objective; the proper interpretation of gynaecological symptoms is based primarily on a sound knowledge of the relevant pathology. Added to this there must be a good working knowledge of the endocrinology of the reproductive system (and a sane approach to its application), and finally an understanding of psychosomatic factors in the production of gynaecological symptoms. These are the aspects of didactic gynaecological teaching with which the student needs guidance; the balance is essentially factual material which can safely be left to one of the many excellent text-books of systematic gynaecology and to the clinical teachers in their wards and operating theatres.

A twofold approach to this matter has been developed at the Queensland school: (i) The department of obstetrics and gynaecology has made itself responsible for the more detailed study by students of the relevant pathology. Each student has (in addition to his set of class slides in general pathology) a smaller set of slides dealing exclusively with obstetrical and gynaecological histopathology. These slides are the subject of tutorial classes to each fifth-year group and again receive the attention of students and a special tutor during each of the sixth-year "refresher courses". Every student is examined on "slides" as part of his final clinical examination. (ii) The didactic lectures in gynaecology are given by a small panel of three lecturers. One lecturer, who also does much of the clinical teaching, deals as far as necessary with systematic gynaecology (15 lectures). Another lecturer (who is also the professor of obstetrics) picks up the threads of earlier teaching on endocrinology and carries it into the gynaecological sphere in a short course of special lectures. Finally, a gynaecologist of senior consultant status gives five lectures on psycho-somatic and sociological factors in relation to gynaecological symptoms.

This didactic teaching, of course, does not achieve very much unless these aspects of gynaecology are reiterated in the clinical teaching, and this we attempt to do. Ideally students should also do some "field work" with a social service worker during their clinical term in gynaecology.

IX. To Bring Students into Contact with the Type of Gynaecological Disorders Most Likely to be Encountered in General Practice.

Although the need for attention to this aspect of gynaecological teaching may seem too obvious to require further elaboration, it is not always easy to put the idea into practice. There is little doubt that many of the "routine" admissions to gynaecological wards of teaching hospitals, whilst providing useful clinical material, have little in common with the variety of minor gynaecological ailments encountered in general practice. It is important, therefore, that in-patient teaching should be combined with adequate instruction in the gynaecological out-patient departments, leucorrhœa clinics and the like. The difficulty we have found lies in providing "adequate instruction". Student years grow larger, and an increasing

number of patients are being referred to out-patient departments. The visiting medical staff, however keen on the teaching side of their work, find that there is little time left to discuss the interpretation of symptoms or the treatment of minor gynaecological ailments in anything more than a cursory fashion.

In an attempt to solve this difficulty we have made use of our teaching registrar in gynaecology (a graduate with four years in general practice) to present to students at each out-patient session a leisured elaboration of the teaching points demonstrated by a small but representative number of patients attending on that particular afternoon.

The registrar is provided with a separate room adjacent to the main out-patient department, and because his appointment is partly a university one, he does not feel obliged to "get on with the next case", and, having separate accommodation, does not hold up the work of the clinic by student demonstration or instruction. Nevertheless, the number of patients examined by him does ease the work of the visiting gynaecologists a little, and they in turn can, if rather more briefly, undertake the instruction of another group of students.

The success of such a plan obviously depends as much as anything on the maturity and experience of the teaching registrar. From this aspect at least it is therefore fortunate that graduates seeking to sit for the Membership of the Royal College of Obstetricians and Gynaecologists are now obliged to serve for two years in a recognized hospital. Thus we find an increasing willingness in men who have actually been in practice to return to hospital registrarships in order to become eligible as candidates for a higher degree.

Conclusion.

A final objective, although one that is in no sense peculiar to obstetric training, is surely to create amongst students a sense of pride in, and an affection for, their training hospital. The training school that provides an "open door" for its graduates to return at any time for discussion with their one-time teachers about (in this instance) current obstetrical or gynaecological problems will exert an ever-widening and useful sphere of influence.

A STUDY OF THE SIGNIFICANCE OF Rh ANTIBODY TITRATION DURING PREGNANCY.

By BARBARA J. ARNOLD, R. J. WALSH and the late RUTH HERZGER.¹

From the New South Wales Red Cross Blood Transfusion Service, Sydney.

If an Rh-negative woman develops Rh agglutinins in her serum during the course of pregnancy, it may be stated that the foetus is Rh-positive and that it will suffer from hemolytic disease of the new-born. On the other hand, agglutinins detected in the early part of pregnancy are usually the result of previous immunization and their presence is no indication of the Rh status of the foetus. In these circumstances many workers have attempted to correlate changes in the titre of the maternal agglutinins with the Rh type of the foetus, believing that an Rh-positive foetus increases the titre of the agglutinins. Large changes are undoubtedly of significance but of rare occurrence, and in most instances one cannot be certain that small variations are not due to experimental errors. The result of any titration depends on many factors, including the test cells used, the particular media used to dilute the serum and to suspend the cells, the accuracy of the dilutions and the temperature at which the tests are performed and the results read. It has been our experience that widely different results may be obtained on different days on the same sample of serum.

¹ Died June 12, 1950.

In an attempt to reduce the experimental error, the principle of parallel titration was adopted. When a sample of serum obtained early in pregnancy was found to contain Rh agglutinins it was frozen at -12°C . A further sample of serum was obtained later in pregnancy. The two samples were then titrated against the same suspensions of test cells with the same diluents. It was assumed that there was no deterioration in the titre of agglutinins in serum frozen for about six months; experience with Rh-testing serum preserved in this manner makes it probable that this assumption was justified.

The results of parallel titrations in a series of 36 patients are the subject of this report.

Methods and Material.

The specimens of serum investigated were obtained from pregnant women attending private practitioners and antenatal clinics. The first samples were frozen at -12°C . and thawed when the subsequent samples were received.

Serial titrations were performed in small test tubes by the usual drop method. When the serum under test contained complete antibodies it was diluted with saline and tested against saline suspensions of red cells, but in all instances titrations were performed in protein media. For the latter purposes the serum was diluted with fresh pooled homologous serum and the cells were suspended in a 30% albumin solution. On all occasions the cell-serum mixtures were incubated at 37°C . for sixty minutes and then centrifuged lightly before being transferred with a Pasteur pipette to slides for examination with the low-power lens of the microscope. In every case suspensions of several cells of known genotype were used so that anti-C and anti-E could be identified in addition to anti-D. The titre was expressed as the reciprocal of the greatest serum dilution causing agglutination, and where the end-point differed against cells of similar genotype the range of titre was recorded.

Results.

The patients have been divided into three groups as follows: (a) those in whom a rise in titre occurred; (b) those in whom a fall in titre was found; (c) those in whom no definite change could be detected.

The last group includes many of whom the titration end points of the two samples differed by only one tube. We could not feel confident that this was not the result of experimental error and we were not prepared to regard the change as significant. Similar findings were recorded for patients who were delivered of Rh-negative children. We have therefore placed patients in either of the first two groups only if there was a fourfold or greater change in titre.

The Rh status of the infant in the three groups is shown in Table I. In some instances when an Rh-positive foetus caused no apparent change in the titre of the maternal agglutinins, the samples of serum tested were obtained only one month apart. However, a similar short interval elapsed in five of the ten cases associated with a rising titre, and the period of pregnancy concerned in these cases was comparable with that in the seven cases in which no change in titre was found.

In the two instances in which the maternal agglutinin titre fell, the infants were severely affected and both died shortly after birth. The details of one case are given below.

The patient's first three pregnancies resulted in normal infants. She was found to have anti-D agglutinins in her serum at the end of her fourth pregnancy, and the foetus died *in utero* two weeks before term. The infant resulting from the fifth pregnancy, which proceeded to term, died four hours after birth on June 21, 1949. The infant was Rh-positive (cDE/cde) and gave a positive direct response to the Coombs test. During this pregnancy four samples of serum were obtained from the patient and were titrated in parallel together with a fifth sample obtained six days after the birth of the child. The results of these titrations are shown in Table II.

The significant rise in titre which occurred *post partum* in this patient was observed in nearly every case in which a *post-partum* sample of serum was tested. It was

unrelated to the behaviour of the agglutinins during the pregnancy.

When anti-C and anti-D agglutinins were both present, a change in the titre of one was usually accompanied by a similar change in the titre of the other, but this was not an invariable occurrence. In one instance the titre in albumin of the anti-D agglutinin rose from 1:2 to 32:64, whereas that in saline and albumin of the anti-C agglu-

TABLE I.
The Relationship Between Changes in the Titre of Maternal Agglutinins and the Rh Status of the Foetus.

Group.	Number of Subjects.	Rh-positive Foetus.	Rh-negative Foetus.
Titre rising	11	10	1
Titre falling	2	2	—
Titre unchanged	23	17	6

tinin fell from 2:8 to 0. Two weeks after the foetus had died *in utero* and two days before it was delivered, the anti-D agglutinin became significantly stronger and the anti-C agglutinin reappeared with a titre of 32. This case has been included in the group showing a rising titre during pregnancy, in view of the greater importance attached to the anti-D agglutinin.

Discussion.

Levine (1948) has contended that the immunizing agent from an Rh-positive foetus does not pass across the placenta to the maternal circulation before the fourth or fifth month. If this is correct, a change in the titre of maternal Rh agglutinins would not be expected in the early months of pregnancy. It might be supposed that the passage of increasing amounts of Rh antigen later in pregnancy would result in a progressive increase in titre of the Rh agglutinin in the maternal serum. Although this occurred in some instances, it was not observed in the majority of patients in our series.

TABLE II.
Fall in Titre of Maternal Agglutinins During Pregnancy.

Date.	Type of Agglutinins.	Titre.	
		Saline.	Albumin.
21.1.49	Anti-D Anti-C	0 0	128 2
19.4.49	Anti-D Anti-C	0 0	8 to 16 2
24.5.49	Anti-D Anti-C	0 0	8 4
31.5.49	Anti-D Anti-C	0 0	8 to 16 2
27.6.49 (<i>post partum</i>) ..	Anti-D Anti-C	0 0	128 2

A hypothesis to explain the observed facts is that the foetus absorbs the maternal agglutinins during pregnancy. On this basis a rise in titre would be observed when maternal production exceeded foetal absorption, but when the reverse occurred a fall in titre would be found. It is not unreasonable to suppose that in a number of cases production would equal absorption and the titre remain unchanged. We are not able to offer any direct evidence to support this hypothesis, and we do not claim that it explains the pathogenesis of haemolytic disease of the newborn. Obviously the maternal organism will vary in its responses to antigen, and the absorptive capacity of the foetus alone does not determine the severity of the disease. The hypothesis advanced provides merely a working explanation of the observed changes in titre without attempting to explain the mechanism of their production.

It is perhaps significant that a rise of titre usually occurs *post partum* when foetal absorption is no longer possible. In one case there was a pronounced increase in titre after the death *in utero* and before delivery of the foetus.

The question arises whether titrations have any real value in the management of these cases. In view of the general agreement that there is little if any correlation between the titre of agglutinins and the severity of the disease in the foetus, titration is of no value if the agglutinins have appeared during the current pregnancy. Moreover, arrangements for therapy cannot be neglected if agglutinins were present on the first examination, because, as has been shown, it is impossible from the results of titration to predict an Rh-negative child with certainty.

Summary.

Changes in the titre of Rh agglutinins were sought in 36 patients at different stages of pregnancy. All samples of serum were preserved in the frozen state, and those from one patient were titrated in parallel. A rise or fall in titre was nearly always associated with an Rh-positive foetus which suffered from haemolytic disease of the newborn, but the majority of affected infants produced no change in the maternal agglutinins. Whilst examinations for the detection of agglutinins are most important, titration of any agglutinins so found is of limited value as a prognostic aid.

Acknowledgement.

The assistance of many pathologists and obstetricians is gratefully acknowledged.

Reference.

Levine, P. (1948). "The Mechanism of Transplacental Immunization", *Blood, The Journal of Hematology*, Volume III, page 404.

Reviews.

A MEDICAL VIEW OF THE BIBLE.

In "The Physician Examines The Bible", C. Raimer Smith sets down the results of an exhaustive investigation of the books of the Old and New Testaments and the Apocrypha.¹ He brings to light innumerable words, phrases and themes that have greater or less relationship to medicine, biology and allied subjects. A vast amount of patient work has obviously gone into the compilation of the data on which the book is based (a medical concordance at the end takes up 30 pages of small print) and the author's enthusiasm and sincerity are unquestionable. Nevertheless, the final product is rather unsatisfactory, whatever one's approach to it; ruthless pruning and editing are strongly indicated. The author has an irritating way of letting his pen run on into reminiscences, irrelevant medical information, homely medical advice (mostly quite sound, it must be admitted), popular science far beyond the scope of the main theme, and the like. A few examples may be mentioned: the Psalmist's "the plowers ploughed upon my back" provokes a two-page detailed discussion of the causes of backaches; because it is said of idols "noses have they and smell not", the causes of anosmia are listed; the anatomy of the uterus and adnexa and of the heart is explained as a comment on references to the womb and the (metaphorical) heart; a long discussion of heredity and inherited disease is only partly relevant to the first and second commandments. One of the author's main objects seems to be to steer a course between literalist fundamentalism and agnosticism, but by little inconsistencies he manages to be both mauled by Scylla and whirled by Charybdis. Miracles recorded in the Old Testament are explained away or dismissed with great facility, yet amazing prophecies are found and apparently accepted—for example, firearms, gravitation and electricity in the Book of Job, radio, aeroplanes and steam shovels in the Book of the Prophet Isaiah. While he takes care in one place to point out the metaphors, hyperbole and other

figures of speech characteristic of Biblical language and warns against literalism, he yet seems to find connexions between such things as pericarditis and "the heart melteth", and between calcified plaques found in the heart of the mummy thought by some to be the Pharaoh of the Exodus and the "hardening" of Pharaoh's heart. All this is on the debit side. On the credit side are the author's prodigious labours and his manifest desire to find the truth in sincerity; he has produced interesting accounts of many subjects including the Mosaic hygiene laws, medicine and herbs of the Bible, and Luke the physician; his medical concordance is an achievement and is probably unique. On his philosophical and theological treatment of such subjects as the existence of God, miracles, the origin and nature of evil and the problem of suffering, opinions will differ. It is startling to read that if God is "an essence that pervades all nature, perhaps the ether or energy itself . . . He is probably circular", though it must be admitted that Saint Augustine did define God as "a circle, whose centre is everywhere and His circumference nowhere". In his introduction the author states that "there has been no book published recently that examines the Bible from the medical stand-point", and so is apparently not aware of the recently published book "Modern Discovery and The Bible" by a British surgeon, Professor A. Rendle Short, of Bristol. If in a second edition of Smith's book he was willing to prune firmly, he would do greater justice to his basic material.

TRAINING FOR CHILDBIRTH.

A NEW work by an American author following the principles of Grantly Dick Read is "Training for Childbirth: A Program of Natural Childbirth with Rooming-In", by H. Thoms, who is professor of obstetrics and gynaecology at Yale.¹ The book was written to explain to doctors the new ideas on childbirth, and to enable them to pass these on readily to prospective mothers. Some of the subject matter is set out in the form of talks which the doctor gives his patients, preferably at a class in the hospital clinic. These talks take a common-sense attitude and also help women to rid themselves of the many old wives' tales that are common and yet erroneous in many cases. A series of four classes for exercises is also described, as well as instructions for fathers-to-be.

Rooming-in means having the baby in the same room as the mother, and this is a modern development away from the generally accepted custom nowadays when the baby is housed in a separate nursery. However, the author states that rooming-in prevents the "frustrating experience for those mothers who want to love and enjoy their babies". The father is encouraged to be present during the early stages of labour, and the caption of one practical illustration reads: "Husbands are allowed to be with their wives during labour. They make good back-rubbers." Other illustrations show the father in a hospital gown, nursing his baby by the bedside—certainly a far more natural proceeding than looking at a nursery full of howling infants through a plate-glass window and wondering which is his. This book is essentially practical, and all obstetricians can read it with confidence.

A YEAR BOOK OF MEDICINE.

ALTHOUGH of practically the same thickness as its predecessor of 1949, "The 1950 Year Book of Medicine" has increased in length and breadth.² This allows for a larger selection of material from the very wide field concerned, without the need to make the book inconveniently fat—it has in fact 12 pages less than the 1949 volume. Other slight changes in appearance, of a modern trend, are pleasing. A particular feature of the subject matter is a series of articles on advances in the decade 1940 to 1950; there is one at the beginning of each of the five main sections relating to the subject of the section. The editors

¹"Training for Childbirth: A Program of Natural Childbirth with Rooming-In", by Herbert Thoms, M.D.; 1950. New York, Toronto and London: McGraw-Hill Book Company, Incorporated. 8" x 5½", pp. 132, with a few illustrations. Price: \$3.00.

²"The 1950 Year Book of Medicine (May, 1949-May, 1950)", edited by Paul B. Beeson, M.D., et alii; 1950. Chicago: The Year Book Publishers, Incorporated. 7½" x 5", pp. 836, with many illustrations. Price: \$5.00.

¹"The Physician Examines The Bible" by C. Raimer Smith, B.S., M.D., D.N.B.; 1950. New York: Philosophical Library, Incorporated. 8" x 5½", pp. 408. Price: \$4.25.

are the same as before with one omission, G. R. Minot. The section on infections, edited by Paul B. Beeson, contains chapters on the pathogenesis and on the therapy of infections, and then the various types of infection are dealt with separately. Studies on *Listeria monocytogenes*, by N. F. Stanley, of Sydney, are included. J. Burns Amberson, who edits the section on the chest, after a full review of the 1940-1950 period, presents chapters on normal and abnormal physiology and on diagnosis and treatment. Particular affections of the lungs and pleura are then dealt with in order. Prominent subjects are chemotherapy for tuberculosis, mycotic infections and aetiological factors in pneumonokonirosis and lung cancer. A paper on continuous postural drainage, by L. Bedford Elwell, of Brisbane, is included. The section on the blood and blood-forming organs is now in the sole hands of William B. Castle (George R. Minot was formerly the senior editor); it has the longest and most comprehensive of the reviews of advances. An opening chapter on general considerations, which covers some general aspects of related normal and abnormal physiology, is followed by chapters on various forms of anaemia, hypersplenism, polycythæmia, leucocytosis and leucopenia, leucæmia and related disorders, purpura and coagulation defects. The subject of the kidney, which formerly belonged to this section, has been transferred to the next section—that on the heart and blood vessels, edited by Tinsley R. Harrison. This section, apart from the chapter on the kidney and the special review article, has the same chapter headings as in the previous "Year Book". In the final section, that on the digestive system, the editor, George B. Eusterman, has grouped his material into chapters on a simple anatomical basis. The index to subject matter and the index to authors complete a very useful volume of wide interest.

FAVOURITE PRESCRIPTIONS.

In July, 1950, a symposium was published in *The Practitioner* under the title "Favourite Prescriptions".¹ It apparently aroused much interest and, as a result, has now been issued in booklet form. The opening paper, by Lord Horder, considers favourite prescriptions in a general way and defends their use in this scientific age; it is pleasantly written and complete with anecdotes. The other papers are by senior members of the British medical profession and deal with favourite prescriptions in general practice, in pulmonary diseases, in diseases of the nervous system, in skin diseases, in diseases of the ear, nose and throat, in ophthalmology, in surgery and in physical medicine. A good deal of the wisdom of experience is set down here, without morbid fear of empiricism, and the interest shown by practitioners can be understood. It may well be that, as is pointed out in the introduction, "from his laboratory fastness the professional pharmacologist probably shrugs his academic shoulders at the obtuseness of the average practitioner" and "the cynic, with an equally deprecating shrug, probably murmurs something about quackery and 'old wives' tales". Single-drug therapy and the demand for rational indications are essential parts of modern drug treatment, which by its considerable efficacy commands respect. Nevertheless it would involve serious loss to cast aside the wisdom of an earlier generation of practitioners, who achieved a good deal of success in treatment without the specific drugs of today. Much of that wisdom is in this little book, together with a discriminating selection from the newer knowledge.

A YEAR BOOK OF PÆDIATRICS.

It is fifty years since publication of the "Practical Medicine Series" of year books began, and the editor of "The 1950 Year Book of Pediatrics" has celebrated the jubilee by presenting guest editorials written by authorities in their own fields.² As a result the "Year Book" provides a sound historical survey of pædiatrics in the past fifty years, a

detailed review of current writing and thought on the subject, and a glimpse of future possibilities. An introductory article summarizes the year's items of interest in the pædiatric field; their number and importance are considerable. Guest editorials deal with pædiatric progress in the United Kingdom (Leonard G. Parsons), the care of the premature infant (Julius H. Hess), the newborn (Clement A. Smith), development in infant feeding (L. F. Meyer), infantile diarrhoea (Katherine Dodd), pædiatric urology (Meredith Campbell), common respiratory tract infections (John M. Adams), the treatment of tuberculosis in children (Edith M. Lincoln), problems in virus diseases of children (Albert B. Sabin), rheumatic fever in children (Leo M. Taran), pædiatric allergy (Bret Ratner), endocrinology (Nathan B. Talbot), congenital malformations of the heart (Helen B. Taussig), infantile cerebral palsy (Meyer Perlbstein), emotional disturbances in children (Harry Bakwin), children and cancer (Harold W. Dargeon) and an article of particular topical interest entitled "Growth and Development: Trends Toward a Clinical Science of Child Development (1900-1950)" (Arnold Gesell). The current abstracts (taken from journals received by the editors between July, 1949, and July, 1950) are arranged under the same headings as in the previous edition, except that ophthalmology and oto-laryngology are separated and a new section is devoted to tumours. The field of selection has been wide, European journals being well represented. Australian work given a place includes T. Y. Nelson's paper on hydrostatic pressure in the treatment of intussusception, D. B. Cheek and C. S. Hick's original study in pink disease, K. M. Bowden's investigation into the problem of sudden death in infancy, the papers on posture by Jean Macnamara and by E. E. Price, and the report of two cases of arachnoidactyly by C. G. Lambie, K. E. Shellshear and J. L. Shellshear. The volume, which is larger than its predecessors and has a completely new cover design, is handsome and sturdy. It will be welcomed by a wide circle of practitioners.

Books Received.

[The mention of a book in this column does not imply that no review will appear in a subsequent issue.]

"Medical Dictionary", by E. Veillon, M.D.; 1950. London: Lange, Maxwell and Springer, Limited. 9½" x 6½", pp. 1430. Price: £6 6s.

An English, French and German dictionary of medical terms.

"Anopheles and Malaria in The Near East", by H. S. Leeson, F.R.E.S., W. H. R. Lumsden, B.Sc., M.B., Ch.B., D.T.M., and H. J. Yofe, M.D., D.T.M., and T. T. Macan, M.A., Ph.D., F.R.E.S., with an introduction by Professor P. A. Buxton, C.M.G., F.R.S.; 1950. London: H. K. Lewis and Company, Limited. 9½" x 7", pp. 240, with 73 illustrations. Price: 35s.

One of the "memoirs" of the London School of Hygiene and Tropical Medicine.

"Diseases of the Heart and Circulation", by Paul Wood, O.B.E., M.D. (Melbourne), F.R.C.P. (London); 1950. London: Eyre and Spottiswoode, Limited. 10" x 6", pp. 628, with many illustrations. Price: 70s.

A book which attempts to maintain a proper balance in cardiological ideas and methods, to link the past with the present.

"Advances in Internal Medicine", edited by William Dock, M.D., and I. Snapper, M.D.; Volume IV; 1950. Chicago: The Year Book Publishers, Incorporated. 9" x 6", pp. 580, with some illustrations. Price: \$10.00.

Contains comprehensive articles on a small number of subjects.

"An Index of Tumour Chemotherapy: A Tabulated Compilation of Data from the Literature on Clinical and Experimental Investigations", by Helen M. Dyer; 1949. Washington: National Institute of Health, United States Public Health Service. 9" x 11½", pp. 336.

Sets out the results of the treatment of tumours by chemical methods.

¹"Favourite Prescriptions", edited by Sir Heneage Ogilvie, K.B.E., D.M., M.Ch., F.R.C.S., and William A. R. Thomson, M.D.; 1950. London: The Practitioner. 9½" x 6½", pp. 76. Price: 4s.

²"The 1950 Year Book of Pediatrics (July, 1949-July, 1950)", edited by H. G. Poncher, M.D., with the collaboration of J. B. Richmond, M.D., and I. A. Abt, M.D.; 1950. Chicago: The Year Book Publishers, Incorporated. 7½" x 5", pp. 516, with many illustrations. Price: \$5.00.

The Medical Journal of Australia

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All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: surname of author, initials of author, year, full title of article, name of journal without abbreviation, volume, number of first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

MEDICINE AND ATOMIC WARFARE.

At the twenty-sixth meeting of the Australian and New Zealand Association for the Advancement of Science held at Perth in August, 1947, Professor G. V. Portus contributed a paper to a symposium on atomic energy. His subject was "Atomic Energy in the Economic and Political Fields" and he introduced it by quoting the following statement made by President Truman: "The release of atomic energy constitutes a new force, too revolutionary to consider in the framework of old ideas." (See THE MEDICAL JOURNAL OF AUSTRALIA, October 18, 1947, page 483.) Professor Portus dealt with production in industry and the employment of leisure, and with the devotion of the latter to the purposes of adult education of every member of the community. He insisted that the solution of problems associated with atomic energy would take years of complicated adjustment and patience and good temper. If men are not prepared to have patience and to display good temper the result will be incalculable disaster. Professor Portus was expressing the ideas of most thoughtful people, but he spoke, as he generally does, with conviction, and his words made an impression on all who listened to him. The most rational way of escape from the threat of disaster would be, as Professor Portus declared, the placing of atomic energy under international inspection and control. But this could be done only in a world devoid of suspicion and lust for power—the day of the universal brotherhood of man is not yet. In no single country has this ideal state made its appearance, and until that happens it is foolish to think of its manifestation in the international sphere. Though we realize that a third world war would probably see the use of the atom bomb and possibly other forms of atomic energy, men and women who cherish ideals of the extension of brotherly love must not forsake them. At the same time they must try to meet the threat of atomic warfare with preparedness likely to lessen its effects.

Most people have made an effort to learn something about the atom bomb and the extent of the damage which

it may cause. On June 25, 1949, a leading article on medicine and atomic warfare was published in this journal. Attention was drawn on that occasion to a series of papers reprinted in *The Journal of the Indiana State Medical Association* from *The Bulletin of the United States Army Medical Department*. Among the subjects specially mentioned were the three categories into which the medical effects of atomic explosions were divided—trauma, burns and radiation injury—and the organization of large cities to meet attacks made with atom bombs. In this issue we publish the first Rupert Downes Memorial Lecture by Major-General S. R. Burston, sometime Director-General of Army Medical Services of the Commonwealth of Australia. General Burston insists that Australia can no longer rely for safety on her geographical isolation. He points to the vital centres of Australian industry as likely targets for atomic bombs and he also refers to the probability that in a future war Australia will become one of the chief arsenals of the democracies in the Pacific. This fact and the vulnerability of industrial centres in relation to centres of population bear out our contention of June, 1949, that the answer to the atom bomb is not essentially medical, but is chiefly the concern of government departments and town planners. General Burston's conclusion that the primary problem in an atomic attack will be the emergency created by the vast number of casualties from the effects of blasts and burns shows (if indeed such a showing is necessary) that the medical aspect cannot be ignored. Of particular interest is his diagram illustrating the pattern and relative importance of atom bomb injuries in relation to distance from the explosion. His description of the injuries and their zonal distribution is worthy of careful study. He puts in a concise and clear way many of the facts set out in this journal in June, 1949, and gives additional information. This should be considered when possible in conjunction with a symposium which appeared in *The Practitioner* for December, 1950. For our present purposes the most important contribution to that symposium is the first, by Sir Ernest Rock Carling, Consulting Adviser for Casualty Services to the Home Office, who writes on "Morale: An Exercise in Preventive Medicine". The remaining articles deal with atomic radiation physics, the action of radiation on the tissues, the morbid anatomy of irradiation injuries, radiation and genetics, the assessment of possible casualties and damage, the casualty service, the treatment of radiation casualties, the treatment of flash burns and the use of monitoring instruments in civil defence. On each one of these subjects much might be written for the instruction of Australian medical practitioners. Turning, however, to Sir Ernest Rock Carling, we must note his opening statement that to live in the atomic age is perforce to accept the implications, but that when these are fully faced they are robbed of half their terrors. "Fright is one of the fundamental instincts, the basis of the structure and function of some of our organs: but controlled fear is a motive not a weakness." Again, preparation is a potent deterrent to the employment of lethal weapons. Carling writes that some competent authorities believe that Hitler did not use gas against the civil population of Britain because he knew that everyone had been supplied with a respirator before September 3, 1939, and that his own people were not so well protected. An atomic bomb used against an unprepared population would produce an enormous number of casualties; but if

proper preventive measures are taken and regulations are observed, Carling thinks that the number would be reduced by at least 50%. Discussing safety measures, he states that the walls of a row of houses are defence against obliquely-falling γ rays; shelters greatly reduce the danger from falling debris; and for "flash burn" a minimum of protection is needed. "It may be that we shall have to resort once more to respirators, and it is satisfactory to know that the same mask which is efficient for gas is also satisfactory for radioactive and other toxic dusts. Incidentally, it would protect the face from flash-burn." Carling declares that safety will lie chiefly in behaviour, and that behaviour can be learned so thoroughly as to become instinctive. To be learned it must be taught, and he would have medical practitioners undertake this work. It is probably true that medical men are better able than others to appreciate the risks, and it is possibly also true that no one is in a better position than they "to inculcate the right attitude of the people to danger". It is easy to say that medical men should know what can be done to avoid the risks or to mitigate the results, but it is doubtful whether their present knowledge is adequate.

We must presume that the Government of this country has given some thought to defence in atomic warfare and even has plans ready to be put into operation, but that in its wisdom it has not seen fit to take the public or the medical profession into its confidence. This may or may not be the correct attitude for the Government to adopt. There will be some difference of opinion on the matter, but most people will agree that the public needs some reassurance; the medical profession would also like to know whether the Government takes the same view of the profession's capabilities and duties as are taken by Sir Ernest Rock Carling. The members of the profession will be ready to do their duty in any state of national emergency. Surely the time is ripe for those in authority to make some public pronouncement, or at least to communicate with the medical profession as a body.

Current Comment.

BLOOD CHANGES DUE TO IONIZING RADIATION.

THERE is a growing literature dealing with the various physical effects of ionizing radiation on human beings exposed to atomic bomb explosions. In some of this considerable attention has been paid to the hæmatological effects, while in others the serious and often lethal action of heat and blast has been stressed. It is right to point out, as has been done publicly of recent times, that no panic should be started about the dangerous possibilities of atomic radiation on the blood-forming organs and the genetic tissues of the body, but it is none the less important that a clear understanding be established among physicians of what should be looked for in an area subjected to this type of explosion. George V. LeRoy, a member of the United States Atomic Energy Commission, has published by permission the results of detailed hæmatological studies performed in Nagasaki and Hiroshima.¹ This record is of medical value, as it gives the results of blood investigation of a large group of people who were exposed to a very variable degree of radiation. The present account covers only the condition of the peripheral blood, and it is proposed to present a description of the marrow changes later. Fortunately, LeRoy has been able to summarize his findings

in very simple terms, and to show that the necessary examination can be made with modest equipment. Two groups of persons have been studied, those in whom the diagnosis was made of "radiation injury", and those who survived at least twenty days after exposure to a comparable degree of radiation. Criteria were established for the diagnosis of radiation injury by the Joint Commission; the symptoms included specific types, such as epilation and purpura, and suggestive types such as vomiting, oropharyngeal lesions and other hæmorrhagic manifestations. The second category of patients included those who had suffered exposure of eight grades, distinguished by the information available as to the distance and protection from the explosion centre, as described in the case histories. The degrees of radiation injury were also divided into very severe, severe and moderate. It will be appreciated that the chaotic state of affairs in Hiroshima and Nagasaki did not permit a ready assessment of the lesions caused, but the commission was able to some extent to ascertain the changes caused by varying degrees of damage, and to relate these to the degrees of protection by distance or by more or less solid structures which afforded shelter. In the article by LeRoy detailed information is presented about the number and histological characters of all the formed elements of the blood, and some clotting studies and Price-Jones curves are recorded. From a study of all this evidence it has been possible to build up a picture of a clinical syndrome and of a blood state which is typical of the condition. It has been found important to take the time factor into consideration, and the elements of the combined clinical and hæmatological picture appear at various times after the exposure. The most important finding is that the severity of the symptoms ran parallel to the severity of the leucopenia, which is, of course, familiar as a characteristic feature of radiation exposure. Similarly, the most severe symptoms occurred about the time when the white cell count was lowest. Parallel to the lowering of the white cell count ran the variations in the thrombocyte count, and the tendency to hæmorrhagic episodes. The red cells did not show changes which were diagnostically comparable to those in the white cells, and therefore red cell counts were not a reliable prognostic. On the other hand, the Japanese physicians found that the patients whose leucocytes numbered less than 500 per cubic millimetre were those least likely to recover. The commission cannot confirm the accuracy of this observation, but their findings are consistent with it. LeRoy confirms the truth of the generalization of Minot and Spurling about radiation such as that used in short wave Röntgen therapy, that "the greater the dose, the more profound is the blood damage, the more rapidly it develops and the more slowly it is repaired". The final conclusions we may accept are that in an emergency the only forms of hæmatological examination necessary are a leucocyte count, an estimation of hæmoglobin, the hæmatocrit reading and estimation of the blood protein content by the copper sulphate method. In fact, it will be seen that this list of tests could be further reduced if a serious emergency occurred. This is a timely publication for the dissemination of useful knowledge, for radiation effects may not be a negligible peril in the future, even if they are not derived from atom bombs.

OZENA.

OZENA is a thoroughly disagreeable condition, the management of which has not so far been very satisfactory. The development of rational therapy has naturally been difficult in the absence of unanimity regarding its causation, though there has been no dearth of suggested factors. A foul odour often accompanies nasal disease of specific origin, such as tuberculosis, syphilis, leprosy and cancer, but ozena has long been recognized as a clinical entity, and it is over the causation of this entity that confusion still exists. The most favoured theories of aetiology, according to William C. Thornell,¹ are predisposing hereditary

¹ Archives of Internal Medicine, November, 1950.

¹ Archives of Otolaryngology, July, 1950.

and anatomical characteristics, structural changes, bacterial invasion, endocrine disturbances, degeneration of the sphenopalatine ganglion and vascular changes of the nature of *endarteritis obliterans*. Thornell suggests that ozena may be produced by a combination of several factors and may not always be attributable to one. Heredity appears to play a part, as does structural development of the nasal passages; to these may be added suppuration of the nasal cavity and accessory sinuses, endocrine disturbances and perhaps occupational factors. The *Klebsiella* organism first described by Abel has been suggested as the aetiological factor; others have favoured a saprophyte. It is interesting to note that in a series of patients, the results of whose treatment Thornell records, *Klebsiella* organisms were grown from nasal swabs in all cases; though Thornell is careful to point out that it must not be inferred from these studies that he considers ozena to be of bacterial origin. The clinical and the microscopic pictures suggest infection, though from animal and human experiments it does not appear to be transmissible; culture of nasal swabbings in suspected early cases of ozena has not always yielded *Klebsiella* organisms, though faults in culture technique have sometimes been responsible. The interesting point is that Thornell has obtained encouraging results from treatment with streptomycin and nitrofurazone ("Furacin"). The number of cases reported is too small to permit the drawing of definite conclusions, but the results indicate that the treatment merits further investigation. Injections of 0.4 gramme of streptomycin or 0.5 gramme of dihydro-streptomycin were given every twelve hours for ten days. In almost all patients crusting and odour disappeared by the third to the fifth day. Permanent atrophic changes were unaffected. The patients were then instructed to use a streptomycin nasal spray for five days, applying one gramme of streptomycin in 10 millilitres of isotonic saline solution each day. Of 15 patients treated, seven had great improvement which has continued with practically no symptoms, two had 75% to 80% improvement, two had 50% improvement, three had no improvement and one failed to report results. Later recurrence of crusting and odour in some cases suggests the development of streptomycin resistance by organisms involved. Nitrofurazone topical therapy has been tried with seven patients, in the form of a spray applied every two hours, with results estimated at 50% to 90% improvement. Clinical investigations with chloramphenicol ("Chloromycetin") are now under way as a result of reports of its effect on *Klebsiella* organisms. It is certainly desirable to find an antibiotic to substitute for streptomycin, with its well-known disadvantages. The rationale of the use of these drugs is, of course, not clear, and Thornell stresses the fact that many patients will never be restored to normal, for although the crusting and odour may be eliminated, the pronounced nasal atrophy and loss of olfactory sensation will remain. However, the elimination of the most disagreeable symptoms would be a real achievement.

THE PRIMARY COMPLEX OF PULMONARY TUBERCULOSIS.

The various stages of pulmonary tuberculosis as they occur at different ages should now be familiar to all who deal with the manifestations of this disease, but it is all the more essential for its clinical and pathological features to be clearly understood today when population groups can be examined by simple means. It is, of course, the action to be taken which needs such careful judgement, and in children this is important. Alfred D. Biggs has published the results of study of a series of infants and children, observed over a period of at least five years.¹ He has made no attempt to discuss the features of generalized or meningeal tuberculosis in the young, nor the relationship of these forms to the primary infection. There is no

novelty in this presentation, but it covers some important features, particularly the symptoms, if any, caused by the occurrence of the primary complex. The procedure adopted was to perform tuberculin tests with both purified protein derivative and Vollmer patch tests on patients aged one year and upwards. All reactors had a careful history taken, physical examination was carried out at regular intervals, which varied from a month to six or twelve months, according to the time which appeared to have elapsed since first exposure to infection. Routine examination was also supplemented with blood counts, sedimentation rate estimations, and the examination of gastric washings if necessary. In the early stages radiological examination was repeated every month, the interval extending up to a year as the lesion grew in age. One hundred and forty-two patients were examined from the end of 1944 onwards; more than half of these were under observation for at least five years, and many of them for eight years or more. None of the children who had evidences of a recent primary infection had a raised temperature which could not be accounted for otherwise, and the same applied to the physical signs of respiratory disease. It has been found by some observers that the primary complex may be accompanied by a raised temperature for a time, but this was not found in this series, in which the customary absence of symptoms was noted. Records of weight gain or loss and of growth of height were kept for the first 113 consecutive children, but these showed no significant variations from a control series. The average red blood cell counts did not differ from the average of children attending the clinic. The radiological findings are, of course, difficult to discuss without the visual evidence at hand. A report was made by the radiologist in every instance without his being enlightened as to the results of the tuberculin tests. The picture was studied in the light of this report and of the other data collected about each patient. It was found that the radiological features of the primary complex were not conspicuous, and not *per se* characteristic. The shadows considered to be due to this primary lesion were diffuse in nature, and did not necessarily appear in different parts of the parenchyma of the lung at the same time. The recognized sites were found to be most common in this series, that is, the upper lobes in the first and second intercostal spaces anteriorly, and the lower lobe of the right lung. Increased markings in the hilar glandular area appeared very soon after the parenchymal lesion; in fact the latter was seldom seen without the former. It is no doubt a descriptive expression to call these shadows "soft", and later, after the processes of fibrosis and calcification have become established, to speak of their "hardening". Yet it is desirable to make it clear that the philosopher of language will rightly regard this as an inference and not an observation. The well-known Ghon tubercle represents an end stage in the healing process when calcification has been established. In this series peripheral calcification or a Ghon lesion was observed, or inferred, as our particular philosopher would have it, in only 25%. The massive primary complex, which has been the subject of so much controversy, and has been perhaps unhappily labelled "epituberculosis", was encountered only in three children of the series. In each instance tubercle bacilli were demonstrated in either gastric washings or material obtained by bronchoscopy. These children, in contrast to the others, had definite clinical symptoms; two of them came to hospital on this account, but their symptoms were mild, and less severe than would be expected if associated with pulmonary lesions of similar radiological pattern but different aetiology. Biggs concludes his study by emphasizing again that the primary complex in children is usually asymptomatic, except in the rarer form with a massive lesion in the lung. Rapid drainage into the hilar glands occurs, and in a minority calcification occurs at the original site. Progressive improvement takes place slowly, and these children should be under observation for years, not merely months. There is no need to isolate them, but the author warns us that the presence of tubercle bacilli in the secretions of the lung, such as has been demonstrated in the larger pulmonary lesions, demands precautions against spread of infection to others.

¹ American Journal of Diseases of Children, October, 1950.

Abstracts from Medical Literature.

PÆDIATRICS.

Pertussis in Infancy.

R. K. BYERS AND N. D. RIZZO (*The New England Journal of Medicine*, June 8, 1950) report a follow-up study of 39 children admitted to hospital with whooping-cough, beginning between the ages of three weeks and twenty-three months. Three children had had cerebral defects before their pertussis infection and one had measles with encephalopathy three months after the pertussis; these four were not considered further. Of the remaining 35, 26 recovered apparently without ill-effects. Six were found to have handicaps, permanently compromising their competitive status to a greater or lesser degree: two of them were feeble-minded, three had mental irregularities of the sort often accompanying diffuse cortical damage (one with epilepsy), and one, though showing average intellectual ability, was an emotional cripple. Three children appeared to have suffered temporary developmental damage, from which recovery occurred after a period of years. No cases of asthma or bronchiectasis were discovered. The authors state that as the patients were in some ways selected, the results were probably worse than in unselected cases of the same age group. Nevertheless, a finding of six non-competent persons out of 35 infected seemed to them to indicate that pertussis early in life must be considered an important threat to competence. Further, in the three cases of recovery, it seemed likely that the children's ultimate attainments had been somewhat compromised. Many of the children studied were exposed to known subjects of whooping-cough and could probably have been protected by the use of hyperimmune serum. The authors consider that since pertussis vaccine seems prophylactically efficacious, the risks of its use in infancy are probably outweighed by those of the disease itself.

Congenital Thrombocytopenic Purpura.

R. D. EPSTEIN *et alii* (*The American Journal of Medicine*, July, 1950) have reviewed the literature of pregnancies complicated by *purpura hæmorrhagica* and have found 39 reports of such pregnancies. They present reports of seven similar cases. In the total group of 46 pregnancies the over-all maternal mortality rate was 8.7%; the mortality rate among the children was 26.1%. One-half of the children born living had congenital thrombocytopenic purpura. Within a few months their platelet counts increased to normal and almost invariably remained raised. No correlation was found between the age, parity, manner of feeding the infant, presence or absence of the spleen in the mother and the syndrome in the child. The theories of the pathological physiology of *purpura hæmorrhagica* are briefly reviewed and it is suggested that congenital thrombocytopenic purpura may be the result of the transfer of an immune body, hormone or other substance across the placental membrane which depresses platelet formation in the infant. The

authors consider the presence of this substance to be quite independent of the presence or absence of the spleen in the mother.

Pink Disease.

DUNCAN LEYS (*Archives of Disease in Childhood*, September, 1950) reviews the literature on pink disease and describes his experiences with 31 cases. He lists the symptoms and signs and emphasizes the emotional changes, pointing out that they are the first indications of the disease and that an improvement in mood and interest is the first sign of recovery. Reports of functional pathology give no uniform picture, which the author considers is unusual in an organic disease producing such profound and prolonged illness. He states that there is only one site in the body which can be regarded as regulating the autonomic nervous system in such a way as to cause such disorganization when it is itself the site of a pathological process, and this is the diencephalon; he suggests that pink disease could be a "diencephalopathy". He reviews a monograph by Le Gros Clark *et alii* on disturbances of the hypothalamus, and states that such disturbance would account for most of the changes of pink disease. He discusses epidemiology, pointing out that groups of cases have been repeatedly reported; yet an infective nature for the disease has never been proven. He discusses the theory of nutritional deficiency as a cause, and states that while there are some resemblances to vitamin B deficiency, yet the infants are usually adequately nourished prior to the onset of the disease, and treatment with vitamin B is not dramatically successful. The question of mercurial poisoning is discussed, but the author regards it as an unlikely cause, for the use of mercury in teething powders is extremely widespread, but the disease is unusual. He gives little credence to the suggestion that the disease may be an expression of allergy. He is much more inclined to think that the disease may be primarily an emotional derangement, and that the original description of a "vegetative neurosis" by Selter in 1903 may have been nearer the truth than has been made since. He is particularly impressed by a group of 19 cases occurring in a foundling hospital, described by psychiatrists as a purely emotional phenomenon. Treatment by drugs affecting the autonomic nervous system has been tried by a number of people, including atropine, eserine, acetylcholine, ergotamine and carbamincholine. The giving of salt, as suggested by Cheek and Hicks, is regarded as reasonable because of increased salt loss in sweat and urine and decreased intake, but the author can see little reason for giving desoxycorticosterone. He has treated only one patient by this method, with no significant change in the general picture.

Poliomyelitis in the Newborn.

JOHN L. BASKIN, EDWARD H. SOULE AND STEPHEN D. MILLS (*American Journal of Diseases of Children*, July, 1950) review the literature on poliomyelitis in the neonatal period and report two cases of their own. In the first, the baby was born while the mother was in a respirator acutely ill with bulbar poliomyelitis. On the third day the baby became febrile. Two days

later weakness of the bulbar type developed, examination of cerebro-spinal fluid revealed a total protein content of 300 milligrammes per centum and leucocytes numbering 108 per cubic millimetre, predominantly lymphocytes. The baby rapidly became worse and died. Autopsy confirmed the diagnosis. Examination of the placenta showed no abnormality. The second child's mother developed poliomyelitis two days after confinement. On the fifth day the baby's cerebro-spinal fluid contained a slightly high protein level (40 milligrammes per centum), and on the eighth day he became febrile; the next day he developed flaccid weakness of all limbs, followed by respiratory paralysis and death. The protein level had risen to 120 milligrammes per centum and the number of leucocytes to 44 per cubic millimetre in the cerebro-spinal fluid. Again autopsy confirmed the diagnosis. The authors state that the illness of the first child appears to have been a transplacental infection, for the minimal incubation period of poliomyelitis is regarded as being five days, and this infant was isolated from its mother immediately on delivery.

Abnormalities in Secretion of Adrenal Cortex.

WILLIAM C. DEAMER AND HENRY K. SILVER (*Journal of Pediatrics*, October, 1950) present a detailed report of the clinical, chemical and pathological findings in seven children who presented abnormalities in secretion of the adrenal cortex. In all cases, save one, the conditions were congenital in origin. Five of the patients presented the picture of insufficiency of the substances regulating salt and water metabolism. In each of them the most prominent symptoms were dehydration with poor gain of weight and/or vomiting. The latter often was projectile in character, and in the young infants sometimes led to an erroneous diagnosis of pyloric stenosis. Pigmentation of the skin and mucous membranes was not a prominent finding. The characteristic blood findings consisted of a depression of the sodium and chloride level and an elevation of potassium level. The fasting blood sugar level was normal. The condition of four of the five patients with adrenal insufficiency has been successfully controlled with the help of supplemental replacement therapy for periods up to six and a half years. One patient with congenital Addison's disease died at the age of ten months. Post-mortem study showed almost complete absence of the adrenal cortex and vascular changes of the kidneys, which probably resulted from overdosage with desoxycorticosterone acetate which had been given for the adrenal deficiency. Pronounced eosinophilia was present in the peripheral blood of several patients with adrenal insufficiency, and it is suggested that this abnormality be considered in certain patients with unexplained eosinophilia. Whatever the blood eosinophile level may be, the manner in which injection of adrenocorticotrophic hormone affects it constitutes a useful test of adrenal function, as pointed out by Forsham and collaborators. In three patients excessive secretion of adrenal androgenic hormones was present simultaneously with insufficiency of adrenal hormones controlling salt and water. Two of these patients were females, in whom

pseudohermaphroditism was thus produced. The other was a male with sexual precocity. Increased androgen secretion by the adrenal cortex was manifested by acceleration in the appearance of the epiphyseal centres, accelerated growth in the length of the long bones, precocious sexual development, and abnormally high excretion of 17-ketosteroids in the urine. The eruption of the permanent teeth was not greatly advanced in the seven-year-old patient with other evidences of precocious sexual and physical maturation. The increased excretion of 17-ketosteroids may be the only abnormal finding which is evident during the first year of life in a male patient with the adrenogenital syndrome. A family history of a similar condition was found in two of the female patients with pseudohermaphroditism and adrenal insufficiency. Knowledge of such previous familial occurrence may be of considerable help in the early recognition of congenital adrenal abnormality.

ORTHOPÆDIC SURGERY.

Osteotomy and Marie-Strümpell Arthritis.

W. A. L. THOMPSON AND R. E. INGERSOLL (*Surgery, Gynecology and Obstetrics*, May, 1950) report the results of operative correction of fixed flexion deformity of the spine in five patients with Marie-Strümpell arthritis. They state that the improvement has been symptomatic, cosmetic and functional; the correction has been permanent. Three of the patients have been followed for more than six years and two others for four years.

Experimental Rupture of the Medial Collateral Ligament of the Knee.

EWEN A. JACK (*The Journal of Bone and Joint Surgery*, August, 1950) has carried out experiments on the medial collateral ligament of the knee joint of the cat. He states that this is very similar anatomically to its human counterpart, and the vascular pattern, as determined by indian ink injections, is almost identical. With the cat under anesthesia, the ligament was ruptured by forcible abduction of the extended knee over the edge of the operating table. The medial side of the knee joint was immediately explored to determine the exact nature of the injury to the ligament and surrounding tissues. Displaced tissue in most cases was smoothed back into place, but was not sutured; in a few cases displacement was allowed to persist. The wound was closed, but the limb was not immobilized. At varying intervals after rupture, the knees were reexplored, the naked eye appearance of the damaged area was determined, and the ligaments were removed for microscopic examination. The animals were then killed. The author found that rupture of a ligament usually occurs along a definite line, but is associated with considerable intrinsic damage to the remote parts of the ligament. In spite of this, healing occurs by regeneration of regular collagen to form a new ligament with good tensile strength, provided the ends of the torn ligaments are in reasonable apposition and pro-

vided the blood supply is adequate. The author believes that when lateral instability of the knee after a recent injury suggests that a collateral ligament has been ruptured, wide displacement of the torn ends should be suspected. Accurate replacement can be guaranteed only by surgical intervention; operative repair therefore seems to be justifiable on anatomical grounds. If operation is contemplated it should be undertaken within the first week after injury, when it is easy to achieve accurate repair; this later becomes impossible because of shrinkage and friability of the tissue. In order to preserve blood supply, the areolar covering should be disturbed as little as possible, and the least possible amount of fine suture material should be used to anchor the torn ends in position. Nevertheless, when the tear involves the upper attachment, ischemia of the damaged ligament may prevent normal healing, whatever the treatment adopted.

Fresh Injuries to the Major Ligaments of the Knee.

DON H. O'DONOGHUE (*The Journal of Bone and Joint Surgery*, October, 1950) believes that only one goal is permissible in the care of the young athlete, namely, complete recovery; for, in the majority of cases of severe injury, especially to the knee, if the recovery is not complete, the patient is no longer an athlete. He states that injury is caused primarily by abduction and external rotation of the tibia on the femur, with the unhappy triad rupture of the medial collateral ligament, damage to the medial meniscus, and rupture of the anterior cruciate ligament. The time to diagnose an injury to the knee is at the time of injury. Immediately after injury, a careful examination can be carried out with an ease not possible later, since muscle spasm has not supervened, initial local shock has dulled the pain, and swelling and hemarthrosis have not yet developed. At this time careful, tender examination will reveal with surprising accuracy the following information: the degree of lateral instability, which is a valuable guide to the extent of the damage to the medial collateral ligament; the exact area of tenderness, which serves to indicate the location of the tear or tears; the positive drawer sign, which relates to the integrity of the anterior cruciate ligament; the restriction of extension, which, if present early, before muscle spasm, is an almost infallible sign of meniscus damage. Careful attention to these four findings will often permit diagnosis of a serious ligament injury, even in a patient who has walked from the field with an apparently minor disability. While hemarthrosis, local swelling and pain may later be significant in indicating the severity of the injury, they are not especially diagnostic as to the type of the injury. An early decision as to treatment must be made immediately after examination. Surgery should not be reserved for those cases in which conservative treatment has failed. The knee which is affected by a serious or complete rupture of the medial collateral ligament, a fracture of the medial meniscus or a tear in the cruciate ligament, or any combination of these, should have early and careful repair, not of one or two, but of all damaged structures. Both superficial and deep

layers of the collateral ligament must be replaced and repaired, the damaged or displaced meniscus must be removed, and the cruciate ligament must be repaired or platted. A single flat antero-posterior X-ray picture should be followed by one made with the leg slightly flexed and forcibly abducted. If carried out early, this readily shows the "opening up" of the medial joint space. If the finding is not conclusive, the opposite limb should be examined radiologically. The author considers that the important thing to remember is that there are two distinct layers of the medial collateral ligament. While these two layers may seem intimately blended, they are essentially separate, as is indicated by the fact that they almost invariably tear at different levels. In considering repair, it is essential to inspect both layers, since a major tear in the deep layer may well be, in fact usually is, screened by the superficial layer. The author found that the meniscus will remain with the tibia if the femoral attachment is torn, and may be wholly undamaged. However, if the central part of the ligament is torn, or if the tibial attachment is pulled away, the meniscus is usually displaced and often ruptured. The operation involves suture of both layers of the medial collateral ligament, inspection and, if necessary, removal of the medial meniscus, and inspection and, if necessary, suture of the cruciate ligament; it is clearly described. After operation, the limb is immobilized in a plaster cast for four weeks. Quadriceps-setting exercises and exercises designed to maintain the tone of the muscles about the hip and knee are instituted for the first few days. Weight-bearing is commenced after one month. The author has demonstrated that nearly perfect results were obtained in patients who were examined early if the diagnosis was accurate and adequate operation was performed promptly.

Changes in the Scoliotic Spine After Fusion.

IGNACIO V. PONSETI AND BARRY FRIEDMAN (*The Journal of Bone and Joint Surgery*, October, 1950) have investigated 117 cases of scoliosis in which treatment was by spinal fusion. They found that the growth of the fused segment of the spine in young patients was absent or minimal except when pseudarthrosis occurred. Pseudarthrosis was common in the most mobile segments of the spine. It was almost always present when the entire lumbar section had been fused, and was found much less commonly after fusion of the thoracic section alone. Spontaneous closure of the pseudarthrosis was often observed when the scoliosis became stabilized. In idiopathic thoracic and thoraco-lumbar and paralytic thoracolumbar curve patterns, short fusions of the main curve and one vertebra above and below it gave the most satisfactory results. Increase of the scoliosis following spine fusion was seen when the fused area was either too long or too short. In extensive fusions, increased scoliosis was associated with pseudarthrosis, bending of the graft, or the addition of more vertebrae to the curve. When fusion did not reach the ends of the curve, increase occurred above or below the fused segment. The authors found that the long-range results of surgical fusion for scoliosis have been disappointing on numerous occasions.

British Medical Association News.

SCIENTIFIC.

A MEETING of the Victorian Branch of the British Medical Association was held at Ballarat on Saturday, November 25, 1950. Dr. ROBERT SOUTHEY, the President, in the chair. The meeting in the afternoon took the form of a series of clinical demonstrations by members of the honorary medical and surgical staffs of the Ballarat Base Hospital. Part of this report appeared in the issue of February 17, 1951.

Fibrocystic Disease of the Pancreas.

Dr. R. W. MANSEY presented a girl, aged six and a half years, with a probable diagnosis of fibrocystic disease of the pancreas. The child, who was thin and frail, had a history of frequent attacks of cough and wheezing with great difficulty in breathing. The attacks were usually relieved by sulphonamide therapy, but often required administration of penicillin or even streptomycin. The child gave a history of having bulky stools, but no diarrhoea. Investigation had shown pronounced mottling of the right lung, particularly in the middle lobe, with some apparent collapse of that lobe. Sputum culture had yielded *Staphylococcus aureus*, and faecal fat estimation showed that unsplit fat made up 18% and split fat 23% of the total faeces. Dr. Manser considered that the family history of the child was interesting. A brother had died in the Children's Hospital nine years previously at the age of one year, with the diagnosis of congenital bronchiectasis and a past history of cough, wheezing and diarrhoea. As fibrocystic disease of the pancreas was unknown in Australia at that time, Dr. Manser considered that the condition might possibly have been misdiagnosed. Another brother had died two years later, aged two years, with a history of acute vomiting, cough and wheezing. No post-mortem examination was carried out on that child. A further brother was alive at the present time, aged two years and ten months. He had a history of wheezing and cough since the age of four months, but no history of bowel upset. Investigation of the family history also showed that bronchiectasis had occurred in the mother's family and that a sister and brother of the mother had died of gastro-enteritis at the age of three months and eleven months respectively. Other members of the family suffered from asthma and bronchitis, and the grandmother had died of pulmonary tuberculosis. Dr. Manser concluded by saying that he felt that the child had fibrocystic disease of the pancreas, and that further investigation, such as preparation of a blood amino-acid curve, seemed necessary to establish the diagnosis.

Dr. K. B. BURWOOD explained that he had attended other members of the patient's family who had died. In retrospect, he felt that they probably had cystic fibrosis of the pancreas, although at the time of their deaths that condition was still unknown. He felt that the patient shown probably also had that disease. The X-ray changes in the lungs were typical, and the finding of *Staphylococcus aureus* in the sputum was also important.

Dr. G. T. JAMES emphasized the importance of the middle-lobe collapse in the clinical story. The treatment of that condition would appear to be lobectomy.

Dr. L. HURLEY felt that numerous faecal fat estimations and even preparation of an amino-acid curve should be carried out to help to clinch the diagnosis.

Dr. R. SOUTHEY stressed the importance of the stunted growth. He said that cystic fibrosis of the pancreas was an entity and the child seemed to fit into the group. The family history in the case under discussion was important. At the Children's Hospital in Melbourne it had been found that 2.5% of all subjects of post-mortem examination had cystic fibrosis of the pancreas. Dr. Southey went on to illustrate the various modes of presentation of children suffering from that condition. The staphylococcus infections often proved insensitive to penicillin and even to streptomycin. In those cases aureomycin might be necessary. At the present time at the Children's Hospital, examination for free fat globules was carried out on successive specimens of faeces. If a fat estimation was made it should always be with a twenty-four-hour specimen, but at the Children's Hospital the amino-acid curve was used in preference to that.

Disseminated Sclerosis.

Dr. E. R. G. SHELL then showed a patient with disseminated sclerosis. The patient was a man, aged thirty-

two years, who had come to hospital four months before with a history which started eight years before that. While in the army he had stumbled and fallen at the end of a long route march, and he had then noticed that he was dragging the left leg; but that recovered the next day, and three years later he was discharged from the army as perfectly fit. The next year he had attacks of weakness in the leg, lasting a few days, but recovered from that, and it was not until the present year that he developed severe stiffness in the left leg and knee with pain in the buttock. He had a feeling of general weakness and became fatigued easily. He had attacks of pins and needles in the left foot, and the left leg felt colder than the right. He had also had bladder precipitancy. Recently he had noticed weakness in the right leg. Physical examination of the patient showed spastic weakness in both legs, greater in the left, and both plantar responses were extensor. Doubtful nystagmus was present; the superficial abdominal reflexes were absent; there was no sensory loss; the fundi were normal on examination. Findings from cerebro-spinal fluid examination were normal, except for a slight increase in protein content to 55 milligrammes per 100 millilitres, and those from blood examination were also normal; both blood and cerebro-spinal fluid failed to yield the Wassermann reaction. Dr. Shell considered the patient to be suffering from disseminated sclerosis.

Dr. J. A. GAME suggested that disseminated sclerosis was the most likely diagnosis. The waxing and waning of symptoms were important. He suggested that a myelogram be carried out to exclude finally any other spinal lesion.

Dr. G. PENINGTON stressed the need to encourage the patient with disseminated sclerosis and not to pass on to him the fell prognosis.

Dr. Game agreed with that and considered that physiotherapy could be of great help in such cases.

Embolism with Amniotic Fluid.

Dr. Shell's second patient was a married woman, aged thirty-three years. She had had four previous deliveries without incident, although in two there was a breech presentation. Her most recent pregnancy had been due to come to term some five months before the time of the meeting. She had come into labour early, and there was easy delivery of a child with a footling presentation. The patient at that time seemed perfectly well, but she lost very little blood, and asked whether a peculiar odour could be smelt. A few minutes later she collapsed with acute pulmonary congestion and severe dyspnoea; cyanosis became pronounced, and there was gross venous congestion. She was treated symptomatically with oxygen and morphine, but became pulseless, and venesection was carried out. A few hours later it was considered advisable to give her intravenous glucose-saline therapy, and at that time it was noticed that the blood removed at venesection had separated into three layers, the upper layer being watery and smelling of *liquor amnii*. The patient remained extremely ill for the next seventeen days, with a high temperature and tachycardia. She was treated with penicillin and heparin, and on the third day, when gross urticaria occurred, "Antistine" was given by injection. She then improved and gradually recovered and was perfectly well at the time of the meeting. Dr. Shell considered that that patient had suffered from embolism with amniotic fluid. He gave as his reference "The British Encyclopedia of Medical Practice: Medical Progress, 1950" ("Critical Surveys", page 29) and "The Medical Annual, 1949".

In answer to questions by Dr. L. HURLEY, Dr. R. SOUTHEY and Dr. E. ROBINSON, Dr. Shell explained that the mechanism of the congestive failure was suggested as being the embolus came from the lower placental site. The cause of the congestive failure was suggested as being due to the effects of the *liquor amnii*. Dr. Shell also stated that, as far as he knew, there was no treatment for the condition, only some 20 cases of which had so far been reported.

Lutembacher's Syndrome.

Dr. G. T. JAMES presented a patient whom he considered to be suffering from Lutembacher's syndrome. The patient was a married woman, aged thirty-one years, who complained of shortness of breath. She had a past history of diphtheria, whooping-cough and growing pains as a child. She had been perfectly well through her first and second pregnancies, but in the current year during her third pregnancy had had to spend the last five months in hospital because of severe shortness of breath. Examination of the patient showed an enlarged heart with thrills present at the apex and the third left intercostal space. A

diastolic murmur was also present at the apex, and a loud, rough, systolic murmur was audible at the third left intercostal space. Fluoroscopy showed the lungs to be very congested with an increase in the transverse diameter of the heart. The pulmonary conus was large, and a very large pulmonary artery could be seen in the left anterior oblique view. There was mild enlargement of the left auricle.

DR. W. KING asked whether pulmonary signs would not have been more definite and a pulmonary systolic murmur might not be expected if the patient was suffering from Lutembacher's syndrome.

DR. H. G. HILLER explained that at the Children's Hospital patients who had been diagnosed as having Lutembacher's syndrome clinically and radiologically were all found to have other lesions when angiocardigrams were prepared. He felt that the syndrome must be extremely rare.

Combined Cardiac Condition.

DR. A. ANDERSON presented the last of the patients of the medical group, a single woman, aged fifty-six years, with a past history of chorea at the age of eight years and then rheumatism in the joints on and off since. Some ten years before she had noticed palpitation, but no shortness of breath, the latter first becoming apparent five years before, particularly after exercise. Oedema of the legs had been noticed eighteen months before she came under observation and it had recurred three or four times. During the last six months she had been conscious of not being able to keep still, and over the last few years of her illness she had lost some four stone in weight. On examination the patient was found to be cyanosed, with distended jugular veins, very agitated and continually on the move. Her blood pressure was 190 millimetres of mercury, systolic, and 120 millimetres, diastolic, and the vessel was slightly thickened. Examination of the heart showed the apex beat to be six inches from the mid-sternal line in the sixth left intercostal space. The cardiac rhythm was fibrillating (she had been receiving digitalis for some time), and there was a loud systolic thrill with a murmur at the apex. Examination otherwise showed five fingers' breadth enlargement of the liver and occasionally some ascites. Investigations were carried out, and an electrocardiogram confirmed the fibrillation and showed a left axis deviation and digital depression of the S-T interval. X-ray examination of her chest showed gross cardiac enlargement with a calcified plaque in the aorta; examination with swallowing of a barium bolus showed gross enlargement of the left auricle. The basal metabolic rate taken very recently was +31%. Dr. Anderson presented the patient for discussion as to the etiology of her condition.

DR. J. A. GAME said that he felt reluctant to give an opinion of the patient's purposeless movements, but he did feel that they were more typical of chorea than of anything else. In the absence of any family history he felt that the condition must be an example of the rare senile chorea, which was thought to be due to degeneration around the basal ganglia.

DR. L. HURLEY pointed out that in elderly people with hypertension and mitral valvulitis the latter was usually found to be of rheumatic origin *post mortem*. He did not feel that the raised basal metabolic rate was of importance in a patient suffering from heart failure.

DR. S. SEWELL considered that the choreic movements would be sufficient to raise the basal metabolic rate, but DR. B. A. BAKER explained that during the taking of the basal metabolic rate there were no movements except around the mouth, and that the pulse rate had remained in the vicinity of 70 per minute.

Multiple Bone Tuberculosis.

DR. J. P. L. GRIFFITHS showed a boy, aged fourteen years, as a subject of multiple bone tuberculosis. The boy had been "picked up" at a mass chest X-ray survey when changes at his right lung base were noted. The result of his Mantoux test (1:1000) was found to be positive, and months later (about fifteen months before the meeting) a repeat of his X-ray examination showed increase in the tuberculous lesion at the left lung base. The results of gastric lavage and culture of sputum were negative for tuberculosis. About that time he complained of pain in the left wrist, but the X-ray appearances were normal; shortly after he developed a right pleural effusion, when he was admitted to hospital, and X-ray examination reports confirmed the condition. X-ray examination of the skeleton showed a large cyst in the left femur, and an intensive

course of penicillin was given. Within two weeks the effusion was absorbed, but the infiltration in the left side of the chest was still further increased, and some two weeks later a large left pleural effusion developed, which necessitated his being admitted to hospital again. The effusion was gradually absorbed, but there was not the same response to penicillin as on the first occasion, and a month later (about a year before the meeting) routine X-ray examination of the left wrist showed decalcification and a fuzzy outline to all the carpal bones. That was considered consistent with a tuberculous lesion, and the left wrist was immobilized in a cast. At the same time swelling of the left little toe and then of the right great toe developed; from the former purulent material was discharged, but no tubercle bacilli were found. At the beginning of 1950 X-ray examination showed decalcification to be greater in the left wrist with two sequestra forming. The right first metatarsophalangeal joint had undergone much decalcification, and the left fifth terminal phalanx had its shaft completely missing. Both those further lesions were considered to be probably tuberculous, and a plaster boot was applied to the right foot; a course of streptomycin was commenced in the dosage of three-quarters of a gramme in the morning and half a gramme at night. A month later para-aminosalicylic acid was also commenced in the dosage of 17 grammes per day, and shortly after this the patient's temperature, which had been fluctuating all along, subsided. Aspiration of the fluctuant swelling around the left wrist became necessary, and again no tubercle bacilli could be found; X-ray examination showed further destruction of the carpal bones in the area. At this stage X-ray examination of the chest showed improvement; X-ray examination of the left sacro-iliac joint showed evidence of tuberculous involvement, and a sinus developed in the perineum on the right side. During the next few months, until about three months before the meeting, there was general improvement in the wrist, pelvis, chest and feet, but at that stage a further X-ray examination showed a diminished joint space between the twelfth thoracic and first lumbar vertebrae, and a swelling which had been noted in the left groin was aspirated. Examination of the fluid removed revealed no organisms and the result of culture was negative; the fluid was considered to be inconsistent with that of a cold abscess and more like that due to chronic irritation. Since that time there had been general steady improvement in the patient's condition; his sedimentation rate was three millimetres per hour. Dr. Griffiths pointed out that throughout the illness the greatest care had been taken in maintaining the boy's general condition, with diet, general tonics and multi-vitamin preparations. The total course of streptomycin had been for a period of 100 days, with para-aminosalicylic acid for about seventy days. He pointed out to the meeting the remarkable growth and development of the boy during his prolonged stay in hospital and the excellent recovery that was taking place in the wrist and great toe. In conclusion, he mentioned that recently a twenty-four-hour specimen of urine had been examined by culture for tubercle bacilli, but no organisms had been found.

Hydatiform Mole.

DR. T. GREENING showed a patient with hydatiform mole.

(To be continued.)

Medical Societies.

MELBOURNE PÆDIATRIC SOCIETY.

A MEETING of the Melbourne Pædiatric Society was held on December 13, 1950, at the Children's Hospital, Carlton, Melbourne. The meeting took the form of a symposium on burns.

Burns as a Hospital Problem: Incidence and Cause of Burns.

DR. N. A. MYERS presented a series of cases of burns and scalds in children under the age of fourteen years admitted to the Children's Hospital, Melbourne, from January 1, 1946, until June 30, 1950, over a period of 4½ years. During this period there were 637 patients, 17 of whom died. The total stay in hospital, calculated in bed days, was 12,798, while the average stay per case was 20½ days. Of the total surgical beds of the hospital, 10% were continuously occupied by those burnt children. Dr. Myers said that

burns were not so serious or so large a problem in the adult hospitals; during a similar period less than 150 cases of burns were dealt with in one of the main adult hospitals, twice the size of the Children's Hospital. The average yearly number of patients suffering from burns was 142, of whom approximately 40% remained in hospital less than ten days, and approximately 9% remained in hospital over fifty days. In 1949 the average stay in hospital was less than in the other years, and that was due mainly to the discharge of the patients from hospital prior to complete healing of the burns. However, during that year the proportion of patients requiring readmission was higher than in any other year. Of the 637 cases, 254 case histories were analysed to assess the age incidence of burns; 8.7% of the cases occurred in children aged under one year, 27.9% in children aged between four and fourteen years, and the remaining 63.4% in children aged between one and four years. Of the 254 cases, 57% were attributable to the child's curiosity and impetuosity, and to failure to keep him "out of the way". One hundred cases of scalds were also studied; in 78 the child was scalded as a result of his pulling over, or upsetting, various household utensils containing boiling liquids. The remaining 22 cases were due to the child's falling into a bath or bucket containing boiling water, and in many of those instances the container was at floor level. The 78 accidents resulting from the child's pulling over or upsetting hot fluids occurred in the toddler age of one to four years.

Dr. Myers then pointed out that the figures clearly indicated the importance of that common problem to both the paediatrician and the community. He said that all cases of burns had a morbidity rate, which bore a direct relationship to the period spent in hospital. The depth of initial skin destruction was the most important factor. Morbidity also was related to whether infection of the burnt area did or did not occur, and also to the standard of treatment by nursing and medical staff. Many patients required reconstructive surgery later. Such procedures were often tedious and associated with psychological trauma.

Dr. Myers in conclusion stressed the following points: (i) The toddling child, with his natural curiosity, was the child most frequently burnt. (ii) Burns were a serious hospital and community problem. Each year 142 children were admitted to hospital with severe burns and no less than 10% of the surgical beds at the Children's Hospital, Melbourne, were occupied by burnt children. (iii) There was a considerable mortality; 17 deaths had occurred at the Children's Hospital since 1946. (iv) A considerable proportion of patients were left with unsightly scar tissue, which at times was responsible for actual deformity. (v) Burns were preventable. That could largely be achieved by the constant education of parents in the dangers which scalding fluids and hot objects presented to the toddler.

Dr. A. E. WILMOT considered that education of the parents in the danger of the small toddler's being scalded or burnt was the only way in which burns and scalds could be prevented. She thought that the health centres and the kindergartens could play an effective role, especially by the use of suitable posters. The use of posters was being considered by the Health Department.

Other speakers concurred with that view.

Dr. V. L. COLLINS demonstrated a poster issued by the New Zealand Public Health Department, and thought that similar posters should be placed in public places—for example, railway stations, trams *et cetera*.

Dr. D. O. SHIELDS stated that finance was a limiting factor to any publicity campaign, as the Victorian Health Department was inadequately financed by the Federal Treasury. He thought that the attention of the Minister of Health should be directed to the large financial loss, and the loss in health, brought about by burns. Whether that would achieve the desired result was another matter.

Dr. STANLEY WILLIAMS urged that the matter be brought up time and time again until the desired result was obtained.

Management of Burns in the Early Stages.

Dr. A. MURRAY CLARKE maintained that the most important thing in the management of burns in the early stages was to be ever watchful, from the moment the patient was examined, to prevent and to control infection in the burnt areas. Prevention of infection was the answer to prolonged stay in hospital, delayed skin grafting, contractures, much pain and suffering, and even cachexia and death; but it required meticulous attention to detail. One act of carelessness could entirely alter the sequence of events and the outlook for the child.

Dr. Murray Clarke pointed out that practically all burns were a mixture of destruction of the superficial and deep layers of the skin, and it was one's aim to avoid any further injury by strong antiseptics, infection or trauma, which would probably kill already damaged cells. The loss of circulating plasma into the tissues of the burned area and onto the surface was the most important cause of the state of shock which occurred. This loss was most pronounced early, and might continue for forty-eight hours. It was large in amount, and no less a volume than the total normal blood volume could be lost in eight hours if 20% of the body area was burnt. In children, shock was to be expected if 8% of the body area was burnt, and death could occur from a 12% burn unless prompt and active measures were taken. Too often in children an irreversible state was reached before it was realized how severe were the haemoconcentration and circulatory embarrassment. The assessment of that state in terms of the eight clinical stages defined by Dr. Brenda Morrison in 1949 required considerable experience; but the stages were there if looked for. Emphasis was also placed on speed in treatment. If within half an hour of the patient's reaching the casualty department intravenous resuscitative measures were in actual progress, and if within six hours a team trained in the routine of dressings had finished the first dressing, it would often be found that skin grafting was unnecessary, and that with large deep burns grafting would be possible in about two and a half weeks and healing would be complete in six weeks. Dr. Murray Clarke said that they should not be content until that ideal had been attained.

Late Management of Burns.

Dr. A. R. WAKEFIELD said that to understand the problems that arose after primary healing of burns, either spontaneously or with the aid of skin grafting, it was necessary to have a clear idea of the mechanism of wound healing and of the subsequent behaviour of the resulting scars. There were a number of unfortunate and misleading conceptions which had been widely taught and disseminated by passage through successive editions of text-books, and which must be laid like ghosts before any such understanding was possible. The first of those misconceptions was that burns which did not involve the whole thickness of the skin did not result in scar contracture, and that scar disabilities were the product only of whole skin burns. That misconception, he considered, was largely due to a persistence of old methods of burn classification such as that of Dupuytren, which had no accurate clinical significance, and which could be corrected only by the realization that from the point of view of depth there were only three types of burns which were significant and which gave an indication of the subsequent course and prognosis: (i) superficial partial skin loss, (ii) deep partial skin loss, (iii) whole skin loss. It was only in the first type that contracting scar tissue was not a factor. In the second type minute areas of intracutaneous scar tissue between residual epithelial elements, when multiplied many times over large areas and in important situations, did become significant and cause contracture. The second common misconception was that early grafting of burns obviated all such scar contractures and subsequent disabilities. That was much too sweeping a statement; while it was true that the subsequent scar contractures could be greatly reduced by early grafting, and that in the case of relatively small areas away from joints they could be reduced to insignificant proportions, it was equally true that in burns of large areas when portions of the burns were related to joints, significant contractures were the rule despite grafting at the earliest possible moment. Indeed, contraction could be completely avoided only in those few cases in which primary excision of the burn and replacement by whole skin graft were practicable. Dr. Wakefield said that he could not too strongly stress the fact that early grafting of an extensive whole skin burn was not so much a procedure to prevent scarring, although it certainly would appreciably minimize its effects, as a procedure to save life by restoring the impervious integument of the body.

Dr. Wakefield went on to say that perhaps the next most common misapprehension was that burn scars would stretch with time, and that the child would grow out of his deformity or disability. He considered that far from stretching, the immature scar went through a period of active contraction for several months until it reached maturity, when it became softer, flatter, paler and more pliable, but at the same time one of the strong, inelastic and unstretchable tissues in the body. How then was it that the range of, say, a shoulder, from being almost nil a month after an extensive axillary burn, might be appreciably greater one year later? The fact, of course, was that it was not the

scar that had stretched but the surrounding normal skin with its normal elasticity, and that the scar had lifted off the deeper structures where the subcutaneous fat was intact and was raised up as a web when the joint was straightened. All that was not to say that scars could not be ruptured, or indeed, be prevented from contracting by a sufficient force. Of course they could, and of course it was often argued that contractures could be prevented by splinting, and broken down when formed by manipulation. In considering the first argument, that scar contractures could be prevented by splinting, Dr. Wakefield said that in the first place the splint to be effective would have to act continuously, for if it was left off for even a few minutes in the first few weeks or a little longer in the later stages, it could never be replaced without manipulation. Secondly, it would have to act for something in the region of six months. Thirdly, it must start to act from the moment when contraction commenced, when the basic granuloma was beginning to mature—in other words, before the burn was healed and when splints had to be removed for lengthy dressings. Fourthly, it must not only fix the position of a joint, but must absolutely fix the normal skin all around the burn, for they had seen that the scar in contracting dragged on and stretched the surrounding skin. Finally, given that all those things could be achieved, the affected joints must be still normally mobile when the splint had finished its work; that was right enough perhaps for the elbow, when the burn was on one surface only, but certainly not for the hand and fingers. Dr. Wakefield asked what of the burn which surrounded the joint—in what position were they to splint it? How, for example, would they splint a circumferential burn of the shoulder—with the hand in the air to prevent axillary contraction and foster neck contraction, or *vice versa*? It was evident that the scar would win every time, and splints were of very limited value.

Considering the second argument, that scars could be broken down by manipulation, Dr. Wakefield said that a single vigorous manual manipulation would rupture both the scar and the surface. Slow traction would achieve a drag on normal tissues, which would be stretched to the limit of their elasticity and then resume their normal relations as soon as the splint was removed. If a return to function and range could be achieved in that way at the expense of a minimum of stretching, deformity and webbing of the normal surrounding skin, then the method might be useful occasionally. However, never let them think that they had stretched the scar.

Dr. Wakefield then said that the discussion had clearly shown that no matter how efficient and complete the primary treatment, large numbers of burns, apart from the most superficial types, and apart from the burns of small areas in parts of the body where contraction was unimportant, would produce both disfigurement and limitation of function which could not be corrected by any conservative measure. Time and time again one saw children months or years after the burn, whose parents had been told on receiving the child from hospital, healed and well, that there was nothing more to be done and that all was well. Their disillusionment was not long delayed, and it was the more tragic because it was unnecessary. The behaviour of burn scars could be predicted with great accuracy by anyone with a knowledge of the principles involved, and by a careful explanation of what parents and child were in for, early cooperation and confidence could be gained in what was often a long and tedious surgical programme. If the scars were left untreated, psychological upsets from disfigurement and physical handicaps from joint contractures would persist through life. Scars under tension were always unstable, subject to breakdown and ulceration from minor injuries, and in later life not infrequently such ulceration ended in malignant change. On the other hand, few conditions were more amenable to corrective surgery than the burn contracture, and the vast majority of patients could be restored to complete functional activity. Nothing short of full functional recovery should be the goal, even if cosmetically the results fell far short of perfection. The next question to consider was, when should such reconstructive programmes be commenced? The position could be fairly clearly stated. With the exception of a few urgent considerations, no secondary reparative work should be carried out locally on the burned area until the period of initial scar contraction was over—namely, until the maximum of spontaneous resolution and softening had occurred and the scars were mature, soft and pliable. Such a state was never achieved in under three months and often not for a year or two after the burn had healed. Concerning hypertrophy in burn scars, often wrongly referred to as keloid, Dr. Wakefield said that the underlying pathology was obscure, but the most important observation was that

hypertrophy in burn scars was closely related to the depth of the burn. When there was superficial partial skin loss only, hypertrophy was most uncommon. In deep partial skin loss it was quite common, and in whole skin loss with spontaneous healing it was the rule rather than the exception. Its degree varied widely, as also did the time taken to resolve, which could be anything from three months to years. Raised, red, hypertrophic burn scars in children were in themselves not an early indication for treatment unless they were producing deformity or were under considerable tension. In most cases they would resolve in time to produce a surface which was better than any grafted skin in appearance, and if they were still drawn up in webs or were the cause of tension on surroundings, they could later be the subject of rearrangement rather than sacrifice. Certain urgent considerations indicated early secondary intervention, the most important being burns on the face and hand. On the face early ectropion of the eyelids, with eye exposure, was one, and on the hands, dorsal contracture with hyperextension of the metacarpo-phalangeal joints similarly demanded early correction.

Dr. Wakefield went on to say that it had to be remembered that a severe burn produced severe constitutional and mental upsets which demanded time for readjustment, and no long secondary work should ever be commenced until the child was back to normal general health and happily reinstated in his family. Further adjustment periods were also necessary between stages in reconstructive work, and multiple operations in quick succession were just as disastrous to the child generally as they were to the condition locally. Time was always on the side of the surgeon doing that work and was undoubtedly the greatest ally he had. One must be coldly analytical of all those factors, and never allow extraneous influences such as the parents' desire to "get it all over quickly" to creep in. The procedures must be deliberately planned in advance, and no risks were justified in such operations of election. The only luck that one ever observed in surgery was bad luck, and that particularly applied to reconstructive work.

Dr. Wakefield said that with all those considerations in mind, the procedures to be carried out became merely a series of technical exercises based on the three primary principles of any reconstructive surgery: (i) to assess the type and quantity of tissue that was missing; (ii) to replace the tissues that were left in their normal position and relationship; (iii) to substitute for what was missing, tissue of a like kind and in like amount. So, if skin only was lost, then skin only was replaced in the form of free skin grafts. Those might be either whole skin or split skin grafts. Whole skin gave better texture and did not contract, but was harder to use and brought new problems in relation to the donor site if of more than small size. Split skin was poorer in texture and would contract, but produced no donor site problems. Thick split skin grafts cut with the dermatome frequently offered the best compromise. If skin and subcutaneous tissue were lost, then skin and subcutaneous tissue must be replaced in the form of pedicled flaps, either from local sources in the form of "Z" rearrangements, rotations, advancements and transpositions, or in the case of more extensive areas, by flap migration from a distance. If deeper structures were involved, then they too must be replaced as far as was possible by tissues of similar kind and amount to build up contour or to restore function.

Those were the principles involved in the late management of burns. Dr. Wakefield said that it was not part of his function to enter on any detailed consideration of technical procedures. In conclusion, he emphasized certain facts concerning children's burns as a social problem. (i) Burns were essentially a problem of children in the community except for occasional industrial disasters, major fires, *et cetera*; children's burns were endemic, adults' burns were sporadic. (ii) Children's burns occurred overwhelmingly among the poorer classes, where supervised play areas were limited and where the children were constantly in the kitchen; where heating devices were cheap and nasty, and maternal intelligence was perhaps at a premium. (iii) Burns increased in times of national emergency, makeshift and hardship. (iv) A new crop of burns appeared with every new heating device that came on the commercial market. (v) The treatment of burns was a major hospital problem. (vi) After-care, rehabilitation and schooling were a major social problem. (vii) The national loss from loss of life, loss of working capacity, failure to marry, and costs of treatment in time, personnel and materials was tremendous. (viii) Burns could be prevented. How? Perhaps by (a) national and domestic education both of parents and of children, to the dangers, (b) legislation to prevent parental neglect, to place responsibility, to enforce safeguards in the home, and to ensure that no domestic heating devices were marketed without adequate safeguards. At

least that would be a start. Finally, if a community such as that in which they were living was unable to tackle the problem of adequate facilities for the treatment of burns in peace time, Dr. Wakefield asked how it could even start to cope with what would happen if an atom bomb was dropped.

Correspondence.

GESTATIONAL RUBELLA AND THERAPEUTIC ABORTION.

SIR: The criticisms by Dr. M. Kelly of prophylactic abortion in rubella may not be so sound in fifty years. A serum test may then determine rubella and which child is vulnerable. It may then be a good thing to kill the child and save it from blindness, for fewer would then be killed by mistake. As has been pointed out, this would save the mother from worry (of course). It would also save after-trouble. For example, the difficulties which Helen Keller has contended with would have been avoided if she had been killed before birth. Others, less gifted, become a burden to society, and this also could be prevented. But we may have to wait years for such tests. Meantime the reasonable procedure (and, of course, human reason is the highest arbiter) is to allow the child to grow up until its faculties can be assessed. Those who fail can be dealt with. It is unreasonable to stop at rubella. We could comb the institutions and the private homes where the afflicted are cared for. Here we could pick up those who escape the pre-natal killing, or those who became afflicted in the post-natal stage of animal development.

The principle could reasonably be extended to cover social difficulties. Think of the aging parent who refuses to die and obstinately mismanages the family fortune. Or the aged grandparent in whom cerebral arteriosclerosis has loosened the silver cord, and whose temperament is now refractory, reason gone, and habits dirty. Think how many of our scarce hospital beds are occupied by "chronic hearts" perhaps tired of life, or by alcoholics who are rehabilitated after months of expensive treatment, discharged on a pension, and then relapse again, and again. And the hemiplegic! And the senile fractured neck of femur! And the tuberculous! And the cancerous!

Abuse could be prevented, as is well known, by government departmental administration. This would have the added advantage that it would be impersonal, and keep the whole thing upon a proper rational and material basis.

The principle would, with inevitable logic, extend to the political sphere. Those who are inconvenient to the party in power or to the policy of the day could be "liquidated".

And unacceptable neighbours in adjoining countries? The curette would here be an inefficient instrument. Gas chambers would be better—perhaps only for the deaf and blind. The more able-bodied could be cheap labour.

Think what a help this principle would be in science. The mechanisms of death by freezing, changes in atmospheric pressure *et cetera* are not well understood. Healthy prisoners of war could be used for all this—under scientific medical supervision. The necessary institutes could be attached as annexes to the departments of those professors who approve of the principles.

Only two things stand in the way of this scientific progress—the law of God and the natural moral law. These, of course, could be ignored (as already in this discussion), and kept concealed as much as possible from the coming generation. Above all, Christian teaching must not obtrude, for if the children were brought up well saturated in this, it may be difficult later to find professors who would cooperate in the necessary experiments and other procedures.

Am I exaggerating or describing fanciful things? Of course not. They are already written in history, even in our own times. In human affairs, principles mould an inevitable succession of consequences.

I wonder, is there anything else in this universe, besides and above human reason and materialism and expediency?

Yours, etc.,
V. J. KINSELLA.

235 Macquarie Street,
Sydney,
February 7, 1951.

Post Scriptum.—General practitioners well know the extraordinary depths of special affection which are lavished by a mother upon an afflicted child, blind or mentally defective. In our new dispensation there will be no need for all this love. An old-fashioned teacher once wrote: "And now there remain faith, hope and charity, these three; but the greatest of these is charity." [Douay.] But now we have science. Faith has gone (as witness this discussion); charity will be soon eliminated by the professors; and when these have gone, what is there to hope for? More science?

A CONGRESS OF ANÆSTHESIOLOGY.

SIR: Advice has been received from the Secretary, Department of External Affairs, that an International Congress of Anæsthesiology will be held at the Salpêtrière Hospital in Paris from September 20 to 22, 1951, so as to precede the International Congress of Surgery.

The congress is open to anæsthetists of all nations and in general to all research workers in the field of anæsthetics.

An invitation for interested Australians to attend has been offered.

The organizing committee consists of R. Monod, president, A. Tournay, G. Jacquot, J. Lavoine, M. Thalheimer and P. Huguenard, and the address is the French Society of Anæsthesia and Analgesia, 12 Rue de Seine, Paris, VI.

It would be appreciated if any Australian anæsthetist who intends visiting the congress would advise the Secretary, Department of External Affairs, although it must be mentioned that no official financial support can be offered intending members.

A similar letter has been addressed to the General Secretary of the Federal Council of the British Medical Association in Australia.

Yours, etc.,

A. J. METCALFE,
Director-General of Health,
Commonwealth Department of Health,
Canberra, A.C.T.,
February 2, 1951.

WORLD HEALTH ORGANIZATION: FELLOWSHIP PROGRAMME.

SIR: The following information has been received from the World Health Organization and is forwarded for favour of publication in THE MEDICAL JOURNAL OF AUSTRALIA.

Two fellowships for the training of medical personnel may be made available by the World Health Organization in 1951-1952 to selected candidates from Australia in the fields of tuberculosis and nutrition. The duration of the fellowships will be for a period of up to twelve months and the amount allocated will be 160 United States dollars per month for fellows in resident status in countries whose currencies have been devaluated or 200 dollars in resident status in other countries; 240 dollars for fellows on travel status in devaluated countries or 300 dollars in others.

Selected candidates will receive free travel from Australia to the country of study and the cost of authorized travel within the country of study. They will also receive tuition fees and an allowance for text-books.

Candidates will be required to have gained at least two years' experience in the field in which they will study under the fellowship scheme. The fellowship may be awarded either for the purpose of taking a regular post-graduate course leading to a degree or to observe and discuss practices and techniques or to participate in a study group or seminar or to be attached to a demonstration team sponsored by the organization or a combination of the above.

The successful applicant will be expected to give a written undertaking to the organization that he will either continue or enter the service of the National Health Administration for a period of not less than two years following completion of his course or studies.

Application forms and further particulars may be obtained from the Director-General of Health, Canberra, A.C.T.

Yours, etc.,
A. J. METCALFE,
Director-General of Health,
Commonwealth Department of Health,
Canberra, A.C.T.,
February 9, 1951.

Obituary.

JOHN SOLOMON HARRIS.

WE regret to announce the death of Dr. John Solomon Harris, which occurred on February 2, 1951, at North Sydney, New South Wales.

MILTON GEANEY.

WE regret to announce the death of Dr. Milton Geaney, which occurred on February 13, 1951, at Brisbane.

Post-Graduate Work.

THE POST-GRADUATE COMMITTEE IN MEDICINE
IN THE UNIVERSITY OF SYDNEY.

COURSE FOR D.P.M., PART I.

THE Post-Graduate Committee in Medicine in the University of Sydney announces that, provided a sufficient number of candidates is offering, a course for the diploma in psychological medicine, Part I, will begin on March 12 and continue until the end of November, 1951. Early application is essential and should be made immediately to the Course Secretary, the Post-Graduate Committee in Medicine, 131 Macquarie Street, Sydney. Telephones: BW 7483, BU 5238.

A TRAVELLING FELLOWSHIP TO NEW YORK.

THE attention of readers is drawn to an advertisement appearing in the present issue and calling for applications for a travelling fellowship to New York. The fellowship is the Lewis Cass Ledyard Junior Fellowship of the Society of the New York Hospital. Unfortunately applications have to be lodged with the Director-General of Health, Canberra, not later than March 9, 1951. It is for this reason that this special note has been published. Full particulars are given in the advertisement, and any correspondence about it should be directed to the Director-General of Health, Department of Health, Canberra, A.C.T.

Nominations and Elections.

THE undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

Blunt, John Littleton, M.B., B.S., 1951 (Univ. Sydney), Sydney Hospital, Macquarie Street, Sydney.
Monk, Marjorie, M.B., B.S., 1951 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.
Cromptley, David Oswald, M.B., B.S., 1951 (Univ. Sydney), Sydney Hospital, Macquarie Street, Sydney.
Grant, Gordon, M.B., B.S., 1950 (Univ. Melbourne), Parramatta District Hospital, Parramatta.
Jessup, Alan, M.B., B.S., 1951 (Univ. Sydney), Sydney Hospital, Macquarie Street, Sydney.
Ford, Bruce Francis, M.B., B.S., 1951 (Univ. Sydney), 12 Derby Street, Kogarah.
Dunn, John Talbot, M.B., B.S., 1951 (Univ. Sydney), Royal Newcastle Hospital, Newcastle.
Pearce, Maxwell John Morton, M.B., B.S., 1948 (Univ. Sydney), 23 Darling Point Road, Darling Point.
Orr, John Morgan, M.B., B.S., 1951 (Univ. Sydney), 50 Homebush Road, Strathfield.

DISEASES NOTIFIED IN EACH STATE AND TERRITORY OF AUSTRALIA FOR THE WEEK ENDED JANUARY 27, 1951.¹

Disease.	New South Wales.	Victoria.	Queensland.	South Australia. ²	Western Australia.	Tasmania.	Northern Territory. ³	Australian Capital Territory.	Australia. ⁴
Ankylostomiasis
Anthrax
Beriberi
Bilharziasis
Cerebro-spinal Meningitis	1	1	1	..	..	..	..	..	3
Cholera
Coastal Fever(f)
Dengue
Diarrhoea (Infantile)	4(3)	..	..	..	..	..	4
Diphtheria	2(2)	..	3(2)	..	3(3)	1(1)	..	..	9
Dysentery (Amoebic)	1(1)	..	..	..	..	..	1
Dysentery (Bacillary)	..	3(2)	2	..	1(1)	..	..	..	6
Encephalitis Lethargica
Erysipelas
Filaria
Helminthiasis
Hydatid	..	1(1)	..	..	..	..	..	..	1
Influenza
Lead Poisoning
Leprosy
Malaria(b)	2(2)	..	..	..	..	..	2
Measles	47(15)	..	..	..	..	47
Plague
Polymyositis	52(24)	3(1)	37(4)	23(19)	..	17(6)	..	..	132
Pottacosis
Puerperal Fever	1	..	..	..	1
Rubella(c)	1(1)	..	..	1	2
Scarlet Fever	25(6)	14(8)	5(4)	1(1)	2(2)	2(2)	..	..	49
Smallpox
Tetanus	1	..	..	..	..	..	1
Trachoma
Tuberculosis(d)	23(21)	22(18)	3	14(12)	9(5)	4(2)	..	1	61
Typhoid Fever(e)
Typhus (Endemic)(f)
Undulant Fever	..	1(1)	..	..	..	..	..	..	1
Well's Disease(g)	4	..	..	..	..	..	4
Whooping Cough	5(4)	..	..	..	..	5
Yellow Fever

¹ The form of this table is taken from the *Official Year Book of the Commonwealth of Australia*, Number 37, 1946-1947. Figures in parentheses are those for the metropolitan area.

² Figures not available.

³ Figures incomplete owing to absence of returns from the Northern Territory.

⁴ Not notifiable.

(a) Includes Moxman and Sarina fevers. (b) Mainly relapses among servicemen infected overseas. (c) Notifiable disease in Queensland in females aged over fourteen years. (d) Includes all forms. (e) Includes enteric fever, paratyphoid fevers and other *Salmonella* infections. (f) Includes scrub, murine and tick typhus. (g) Includes leptospirosis, Well's and para-Well's disease.

The undermentioned have been elected as members of the New South Wales Branch of the British Medical Association: Tracy, Graham Douglas, M.B., 1948 (Univ. Sydney), Royal North Shore Hospital, St. Leonards.

Wilcox, Griffith George, M.B., B.S., 1946 (Univ. Sydney), 71 Gray Street, Kogarah.

Streimer, Ludwig, registered in accordance with the provisions of Section 17 (1) (c) of the *Medical Practitioners Act, 1938-1945*, 16 Botany Street, Bondi Junction.

Wolfenden, William Horace, M.B., B.S., 1951 (Univ. Sydney), Sydney Hospital, Sydney.

Weintraub, Saul, registered in accordance with the provisions of Section 17 (1) (c) of the *Medical Practitioners Act, 1938-1945*, 234 New South Head Road, Double Bay.

The undermentioned have applied for election as members of the South Australian Branch of the British Medical Association:

Koop, Peter Malcolm, M.B., B.S., 1949 (Univ. Adelaide), Woolpunda, via Morgan.

Howard, Juliet Hardman, M.B., B.S., 1951 (Univ. Adelaide), 10 Frederick Street, Gilberton.

Hicks, Edward Paul, M.B., B.S., 1950 (Univ. Adelaide), 8 Toowong Avenue, Kensington Park.

Wallman, Richard John Robson, M.B., B.S., 1950 (Univ. Adelaide), Royal Adelaide Hospital, Adelaide.

Wallman, James Douglas Robson, M.B., B.S., 1950 (Univ. Adelaide), 30 Grange Road, New Hindmarsh.

Hoopmann, Eric Paul, M.B., B.S., 1949 (Univ. Adelaide), Madang, New Guinea.

Birdseye, Sydney Allick, M.B., B.S., 1950 (Univ. Adelaide), 11A Hindmarsh Square, Adelaide.

Rischbieth, Richard Harold Charles, M.B., B.S., 1950 (Univ. Adelaide), 34 Church Terrace, Walkerville.

The undermentioned have been elected members of the South Australian Branch of the British Medical Association:

Handley, Harold Arthur, M.B., B.S., 1950 (Univ. Adelaide), Royal Adelaide Hospital, Adelaide.

Davidson, Robert Thomas, M.B., B.S., 1950 (Univ. Adelaide), 12 College Street, College Park.

Kirby, David Bevan, M.B., B.S., 1950 (Univ. Adelaide), 9 Dequetteville Terrace, Kent Town.

Benson, William Herbert, M.B., B.S., 1950 (Univ. Adelaide), 212 Young Street, North Unley.

Dunn, David Everson, M.B., B.S., 1950 (Univ. Adelaide), 38 East Terrace, Kensington Gardens.

Kumnick, Donald Kerr, M.B., B.S., 1950 (Univ. Adelaide), 119 Rose Terrace, Wayville.

Furber, Ian King, M.B., B.S., 1948 (Univ. Adelaide), Port Augusta.

Notice.

A CLINICO-PATHOLOGICAL MEETING of the Thoracic Unit of the Royal Prince Alfred Hospital will be held in the A2 Lecture Theatre, Royal Prince Alfred Hospital, at 7.30 o'clock p.m. on Friday, March 2, 1951. All members of the medical profession are invited, and supper will be served in the residents' quarters.

Medical Appointments.

The undermentioned appointments have been made at the Royal Adelaide Hospital, Adelaide: Resident Medical Officers, Dr. A. R. Anderson, Dr. N. H. B. Black, Dr. W. H. Benson, Dr. S. A. Birdseye, Dr. B. J. Brandstater, Dr. R. A. Brown, Dr. A. K. Cohen, Dr. I. C. Drever, Dr. D. E. Dunn, Dr. J. S. Flett, Dr. F. Geisler, Dr. H. A. Handley, Dr. J. F. Harley, Dr. J. S. Heitmann, Dr. E. P. Hicks, Dr. D. E. Holle, Dr. K. T. Jones, Dr. D. B. Kirby, Dr. E. D. Kirkman, Dr. D. K. Kumnick, Dr. D. R. Lowe, Dr. T. D. Manthorpe, Dr. C. W. Phillips, Dr. L. J. Potts, Dr. E. M. Prest, Dr. R. H. C. Rischbieth, Dr. A. K. McK. Stewart, Dr. H. D. Stewart, Dr. I. D. Smith, Dr. J. G. Sweeney, Dr. M. G. Taylor, Dr. A. B. Vivian and Dr. R. J. R. Wallman; Associate Medical Officers, Dr. D. T. Barnes, Dr. M. J. Drew, Dr. R. E. Dunstan, Dr. P. J. Edwards, Dr. J. H. Howard, Dr. J. F. Jackson, Dr. B. J. Shea, Dr. D. N. Thornton, Dr. A. D. Tonkin, Dr. A. R. Westman, Dr. B. G. Wells and Dr. D. A. Williamson.

Dr. B. G. Thomas has been appointed medical officer of Barmera Hospital, South Australia.

Dr. M. J. Drew and Dr. D. K. Kumnick have been appointed resident medical officers at the Royal Adelaide Hospital, Adelaide.

Dr. I. M. H. Camens has been appointed medical registrar at the Royal Adelaide Hospital, Adelaide.

Dr. R. Osmond has been appointed assistant clinical pathologist at the Institute of Medical and Veterinary Science, South Australia.

Dr. James Henry Russell Tremayne has been appointed Director of Tuberculosis, Department of Public Health, Tasmania. (In the issue of February 10, 1951, Dr. Tremayne's name was incorrectly given as Dr. J. H. Russell.)

Diary for the Month.

FEB. 26.—Federal Council, B.M.A. in Australia: Meeting at Melbourne.

FEB. 27.—New South Wales Branch, B.M.A.: Ethics Committee.

FEB. 28.—Victorian Branch, B.M.A.: Council Meeting.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Medical Secretary, 135 Macquarie Street, Sydney)—All contract practice appointments in New South Wales.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federal Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225 Wickham Terrace, Brisbane, B17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178 North Terrace, Adelaide): All Lodge appointments in South Australia; all Contract Practice appointments in South Australia; Medical Officer, South Australian Railways.

Western Australian Branch (Honorary Secretary, 205 Saint George's Terrace, Perth): Norseman Hospital; all Contract Practice appointments in Western Australia. All government appointments with the exception of those of the Department of Public Health.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to the Editor, THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2551-2.)

Members and subscribers are requested to notify the Manager, THE MEDICAL JOURNAL OF AUSTRALIA, Seamer Street, Glebe, New South Wales, without delay, of any irregularity in the delivery of this journal. The management cannot accept any responsibility or recognize any claim arising out of non-receipt of journals unless such notification is received within one month.

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